APPENDIX A: INFRASTRUCTURE DATA ASSESSMENT REPORT

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MORETON BAY REGIONAL COUNCIL

Infrastructure Data Assessment Report

Package 5

301001-01156 – EN-REP-0002

14 October 2010

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MORETON BAY REGIONAL COUNCIL
INFRASTRUCTURE DATA ASSESSMENT REPORT
PACKAGE 5

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PROJECT 301001-01156 - INFRASTRUCTURE DATA ASSESSMENT REPORT

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for Internal Review	R.Stewart	K.Hegerty		12-Oct-10	N/A	
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CONTENTS

1. INTRODUCTION

WorleyParsons Services Pty Ltd has been engaged by Moreton Bay Regional Council (MBRC) to carry out detailed surface water modelling over four of the regional catchments in their Local Government Area (LGA). The four catchments are Stanley River (STA), Neurum Creek (NEU), Mary River (MAR) and Byron Creek (BYR). These make up 'Package 5' of MBRC's Regional Floodplain Database Project (RFD Project) and are referred to as 'minor basins' in the GIS data provided by MBRC.

At the commencement of this project MBRC handed over an extensive data set including established 'broad scale' models and results. The purpose of this report is to identify and prioritise any additional floodplain infrastructure data which is necessary to complete the detailed modelling associated with the current project.

Due to the expansive catchment study areas of the project, it is difficult to convey the necessary level of data detail on Figures. For this reason an electronic copy of the GIS data associated with the findings of this report has been provided. The following electronic GIS data layers have been provided with this report:

1. "Existing Structure Junctions" (provided by MBRC). A data capture priority rating has been assigned to each of these structures;
2. "Identified Hydraulic Structures". This includes all additional structures identified by WorleyParsons including an associated data capture priority rating;
3. "Identified Basins/Dams". This includes all detention basins and dams significant enough to warrant incorporating into the modelling;
4. "Additional Buildings Identified in Floodplain". Includes buildings in the PMF flood extent that are not already included in MBRC's '"buildings" GIS layer.
5. "Miscellaneous Comments". Includes general comments relating data capture and modelling.

Figures provided with this report are for overview purposes only.

A fee proposal for WorleyParsons to carry out the data capture tasks identified in this report will be provided separately to MBRC for consideration.

2. AVAILABLE DATA AND GAP ANALYSIS

Floodplain Infrastructure Data provided by MBRC has been reviewed. Details of the available data and a gap analysis are provided below for each class of infrastructure data.

2.1 Bridges

Bridge design drawings have been supplied by MBRC for 11 locations within the Package 5 study area. These will be useful for defining geometry of the bridge however it is noted that generally these drawings do not have elevation data on AHD.

In addition to these bridges numerous road crossings have also been identified within the proposed hydraulic modelling area using aerial imagery, digital elevation modes (DEMs), and the supplied hydrography. Identifying road crossings in this manner makes it difficult to distinguish between culverts and bridges. Consequently, when reviewing the catchment data to identify additional waterway crossings we have not distinguished between bridges and culverts.

Each waterway crossing has been assigned a priority rating of A, B or C. This is discussed further in Section 3.1.

No bridge data is currently available in a TUFLOW compatible format.

2.2 Culverts

No culvert details have been provided for any of the Package 5 catchments.

Potential culvert crossings within the proposed hydraulic modelling area have been identified in the same manner as for bridge crossings, as discussed in the previous section. The location of these structures is shown generally on the figure provided in Appendix 1 and they are also included in the electronic GIS data provided with this report.

It is also noted that the location of some culverts may only become apparent with a field inspection. This is likely to be the case for high level floodplain crossings which do not tie in directly with a defined waterway.

2.3 Trunk Underground Drainage

A review of the supplied aerial imagery over the proposed hydraulic modelling area has found no evidence of underground trunk drainage. This is to be expected in these rural package 5 catchments.

2.4 Detention Basins / Farm Dams

No regional scale detention basins have been identified in any of the package 5 basins.
There are numerous farm dams that are large enough to warrant incorporation into the modelling. . The location of these dams are shown generally on the Appendix figures and they are also included in the electronic GIS data provided with this report.

2.5 Terrain

Bathymetry

For the purpose of this report bathymetry is defined as ground elevation level data in areas beneath standing water.

No bathymetry data has been provided for any of the package 5 catchments however some localised sources of bathymetric data have been identified. These are discussed under the respective catchment headings below.

Topography

The topographic data sources which have been provided for use in this study include:

1. 2009 Aerial LiDAR survey. This has been provided as raw xyz data points and also as a 2.5m grid digital elevation model (DEM)
2. A 25m grid DEM has also been supplied by MBRC. It is understood that this is based on the 25m grid that is available through DERM.

The LiDAR survey has been filtered for ground elevation points and is considered to be of high quality and suitable for use in this study. Unfortunately the LiDAR does not provide complete coverage over each of the package 5 catchments. The LiDAR coverage area over each minor basin is shown in the respective catchment heading below.

Modelling outside of the LiDAR coverage areas is expected to be based on the 25m DEM. The accuracy of hydraulic modelling based on the 25m DEM is likely to be subject to errors resulting from inaccuracies in elevations in the DEM. The two grids have been compared and significant elevation differences have been found to be common. A typical floodplain section extracted from each of the grids is shown in the Figure below.

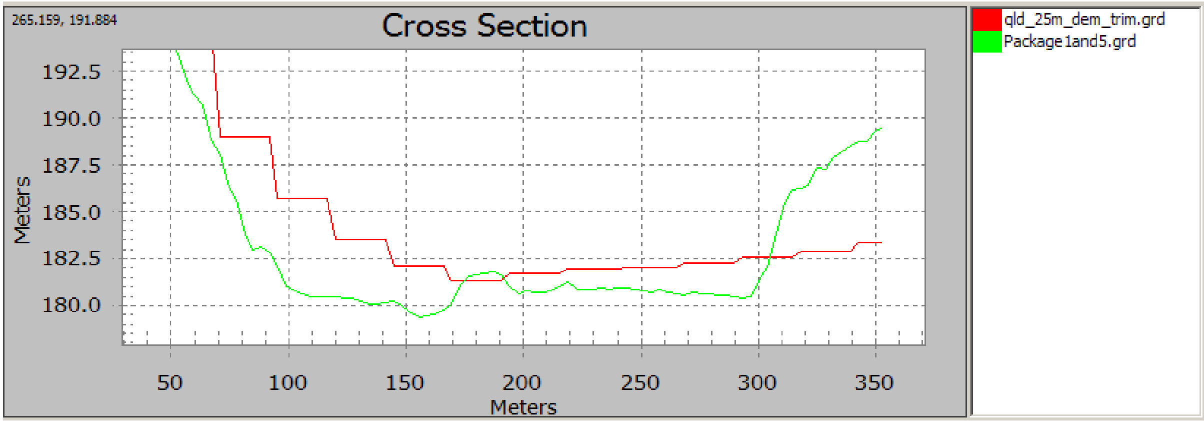


Figure 2.1 – Typical Floodplain Section: 2.5m DEM (Green) vs 25m DEM (Red)

2.5.1 Byron Creek

The coverage of the aerial LiDAR survey over the Byron Creek catchment is shown by the extent of the DEM in the figure below. No LiDAR is available in the south-west corner of the BYR catchment. The accuracy of modelling beyond the LiDAR extents will be significantly limited by the lack of good quality terrain data in this area.

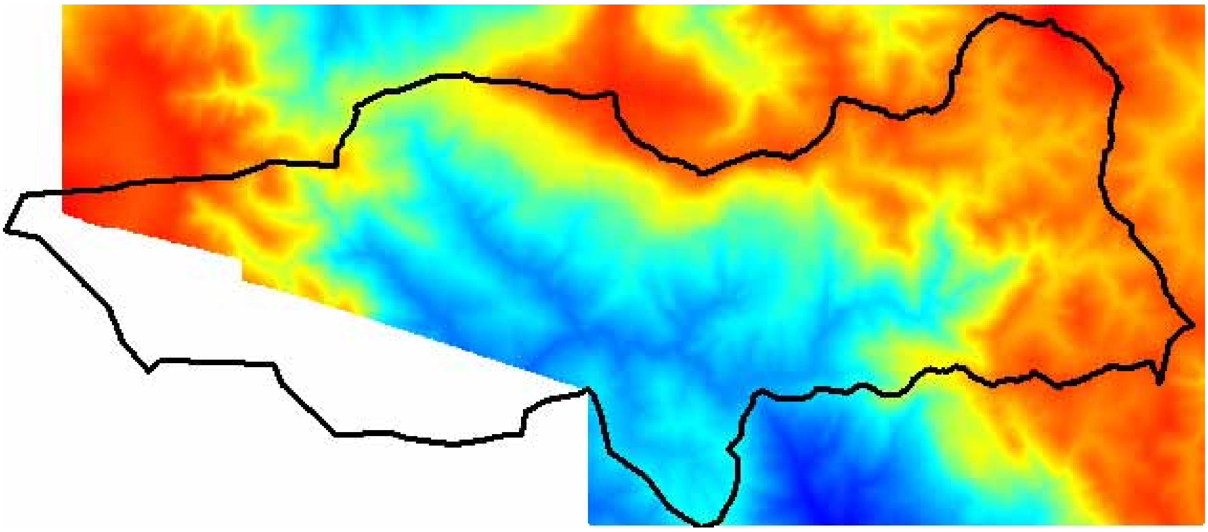


Figure 2.2 – Byron Creek 'Minor Basin' Overlaying LiDAR DEM.

2.5.2 Mary River

The LiDAR aerial survey covers the full extent of the Mary River 'Minor Basin'. It is noted however that an anomaly has been discovered in the supplied 2.5m DEM which appears to have been caused by a tile of data being excluded during the DEM creation. The anomaly, which is illustrated below, is located near MGAz56 coordinate 478,670, 7,035,579.

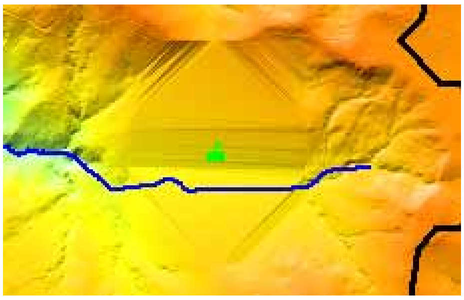


Figure 2.3 – 2.5m DEM anomaly in the MAR minor basin

This anomaly is included in the general comments GIS data layer provided with this report. Fortunately it is situated high enough in the catchment that hydraulic modelling will not be effected.

2.5.3 Neurum Creek

The coverage of the aerial LiDAR survey over the Neurum Creek catchment is shown by the extent of the DEM in the figure below. No LiDAR is available in the north-west corner of the NEU basin. The accuracy of modelling beyond the LiDAR extents will be significantly limited by the lack of good quality terrain data in this area.

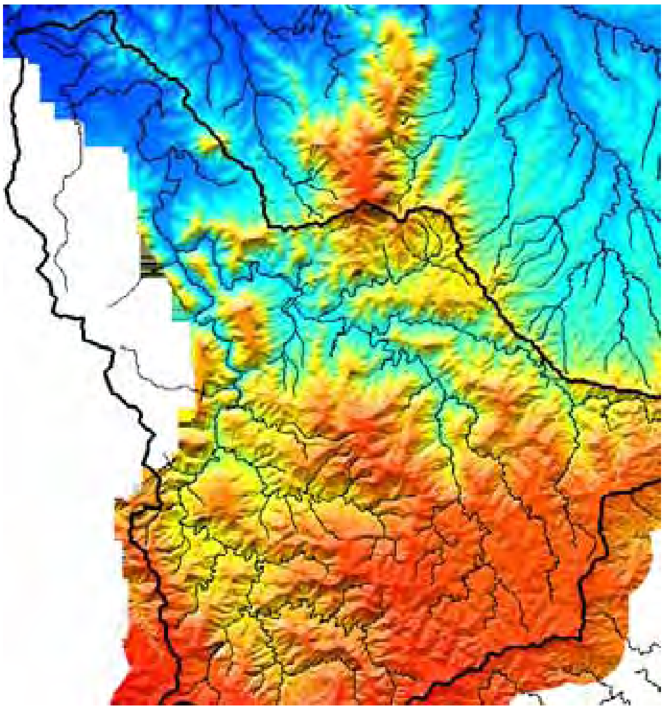


Figure 2.4 – Neurum Creek 'Minor Basin' Overlaying LiDAR DEM.

2.5.4 Stanley River

The coverage of the aerial LiDAR survey over the Stanley River catchment is shown by the extent of the *DEM* in the figure below. No LiDAR is available for the western, downstream portion of the Stanley River minor basin. The accuracy of modelling beyond the LiDAR extents will be significantly limited by the lack of good quality terrain data in this area.

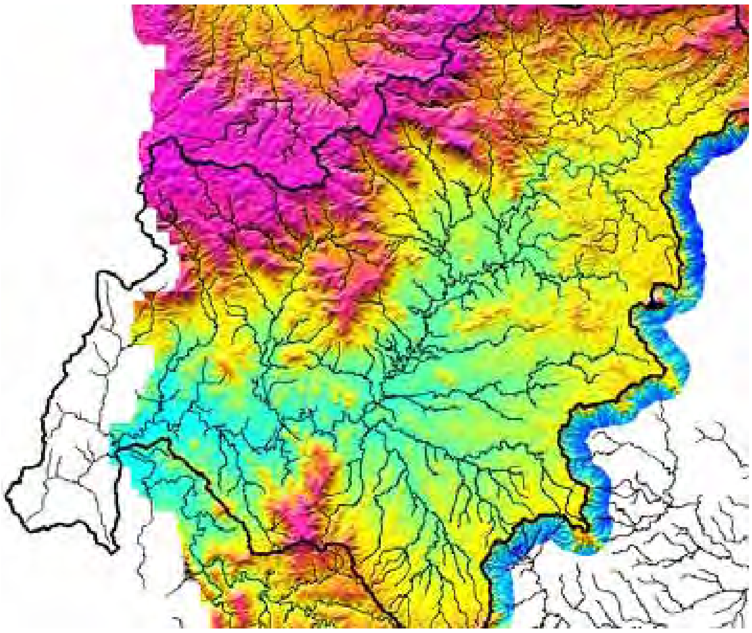


Figure 2.5 – Stanley River 'Minor Basin' Overlaying LiDAR DEM.

Cross-section ground survey was carried out during the 2003 Stanley River Flood Study (Sargent Consulting). This ground survey could be utilised to confirm the accuracy of the LiDAR data and also possibly to model the lower reaches of the Stanley River where LiDAR is not available. The cross-section survey data has not yet been supplied. The cross section survey is also a possible source of bathymetry.

The locations of the Stanley River Flood Study cross sections are shown in Appendix 2.

2.6 Miscellaneous

It is noted that some floodplain infrastructure is difficult to identify by studying aerial imagery and a *DEM*. One such example is in-stream weirs. No in-stream weirs were identified however it is worth confirming with the relevant authority as to whether any exist in these catchments.

Some buildings have also been identified in the floodplain that are not included in the MBRC supplied 'buildings' land-use layer. These additional buildings are also supplied in this report's GIS data layers.

3. PROPOSED DATA CAPTURE

The key additional data capture required for this project is survey of the numerous hydraulic structures including bridges and culverts.

No regional scale detention basins or trunk drainage works were identified and hence no data capture is required for these structure classes.

The majority of the catchment area for each of the minor basins has been captured with high quality LiDAR survey. It would be ideal to obtain additional LiDAR survey over the remaining areas however MBRC may decide to accept a lower level of modelling accuracy in these areas to avoid the large cost of capturing this data.

Data capture tasks have been assigned a priority rating. Details are provided in the following sections.

3.1 Prioritisation Methodology

Hydraulic Structure Overall Priority

Each identified road crossing has been assigned a high, medium or low data capture priority. Prioritisation of the hydraulic structures has been based on the following criteria:

1. Likely impact on flooding characteristics;
2. Proximity to urban areas;
3. Class of road associated with the infrastructure; and
4. Catchment Size.

Based on these criteria each hydraulic structure that has been identified has been assigned a priority class or A (high), B (medium), or C (low). The priority has been assigned by reviewing aerial imagery, DEMS and the supplied hydrography.

By way of example, a dirt road with a minor causeway crossing and no significant road embankment would be assigned a 'C' priority. A significant road crossing in an urban area or on a major road would be assigned an 'A' priority. An example of a 'B' priority structure is a rural road crossing with no surrounding residential properties.

The priority rating of each structure is provided in the GIS data provided with this report ('priority' field).

Priority of Hydraulic Structure Elements

In addition to assigning each structure a priority, a further breakdown in priority has also been assigned to the various elements of data capture associated with each hydraulic structure. This relates to the priority High (or A) and Low (or B) data capture tasks referenced in the project brief whereby priority High tasks are considered critical for a high quality modelling outcome and priority Low tasks could potentially be incorporated with desktop techniques and assumptions.

3.2 Data Prioritisation

Culverts

Each structure has been assigned an overall priority as discussed in Section 3.1. The priority for each structure is provided in the GIS data provided with this report.

In addition to this, each element of data associated with capture of structures can further be prioritised as follows:

Priority High Elements of Culvert Data Capture

Capture of these elements is considered critical to a high quality modelling outcome:

1. Culvert Type (Box / Pipe);
2. Size and number of barrels;
3. Upstream and downstream invert levels;
4. Material (concrete/corrugated iron); and
5. Handrail type and extents.

Priority Low Elements of Culvert Data Capture:

The remaining elements associated with culvert data capture as detailed in the Culvert Data Standard by Aurecon, are considered to have type B Priority and could be incorporated into the modelling using desktop techniques and assumptions. These elements include

1. Wing walls:
2. Road elevation;
3. Handrail elevation;
4. Geo-referenced photos; and
5. Metadata.

Bridges

Each structure has been assigned an overall priority as discussed in Section 3.1.

In addition to this, each element of data associated with capture of structures can further be prioritised as follows:

Priority A Elements of Bridge Data Capture

1. Number / Length of spans;
2. Deck Thickness or soffit level;
3. Pier Configuration (width, shape, orientation etc);
4. Cross section of channel beneath the bridge; and
5. Handrail type and extents.

Priority B Elements of Bridge Data Capture:

The remaining elements associated with bridge data capture as detailed in the Bridge Data Standard by Aurecon, are considered to have type B Priority and could be incorporated into the modelling using desktop techniques and assumptions. These elements include

1. Road elevation;
2. Handrail elevation;
3. Deck levels points;
4. Geo-referenced photos; and
5. Metadata.

Most bridge details are able to be sourced from the supplied bridge drawings however levels on the drawings will need to be converted to AHD and it is noted that not all bridge drawings are complete.

Farm Dams

Priority B

It is proposed that the minor farm dams situated in the upper catchments upstream of the proposed hydraulic modelling extent will not be incorporated into the hydrologic or hydraulic modelling. While these small dams may have some impact on catchment hydrology (dependant on the level at the start of a rainfall event), the amount of work required to incorporate these dams into the modelling is not considered justified given that the impact of these dams is likely to be negligible if the dams are full at the start of a rainfall event.

While the farm dams in the upper catchments can justifiably be excluded from the modelling, there are several dams situated farther down in the catchments that are within the proposed hydraulic modelling area and are considered significant enough to warrant incorporation into the modelling. It is anticipated that the influence of the dam embankments on local hydraulic behaviour will be more significant that the storage effect of the impounded water.

It is proposed that these dams should be incorporated into the hydraulic model as follows:

1. Incorporate significant dams into the hydraulic modelling by creating a dam crest breakline. Ideally this should be based on Ground survey however a reasonable approximation should be possible in a lot of cases using aerial LiDAR survey; and
2. Defining initial water levels for the 2d grid within in each dam. It is recommended that a reasonable and conservative approach for this is to assume that the dams are full at the start of each simulation.

Terrain

Priority B: Stanley River Flood Study Survey

It is proposed to utilise the Stanley River Flood Study survey as follows:

1. Compare with cross section ground survey with the 2009 LiDAR survey to confirm accuracy of the LiDAR
2. Utilise the in-bank survey points to supplement the definition of the channel (including bathymetry.
3. It is also worth looking into what structure survey was carried out for the investigation

While having this data would be beneficial we suggest that it is not absolutely necessary because the LiDAR aerial survey is able to provide a reasonable representation of the major water course channels. This can be assisted by the use of stream gully breaklines.

Priority B: Stream Widths

It is noted that a stream width functionality has been included in the DEM processing utility developed for this project. A stream width field can be applied to the breakline strings that will be getting developed for the project. This is also considered to be a type of ‘data capture’ task in that it will improve the quality of the DEMs that will be generated for the project.

Miscellaneous

Priority A

It is proposed that relevant authorities should be contacted to confirm the existence of any instream weirs within the study area. If any are reported, then location and geometric details should be attained.

4. RECOMMENDATIONS

WorleyParsons recommends that MBRC should undertake or commission the undertaking of all data capture tasks detailed in this report. If budget and timing constraints limit the potential for this then, as a minimum, all data associated with priority “A” structures should be collected.

5. REFERENCES

Aurecon, July 2010, "Data Standard - Culverts, Regional Floodplain Database - Stage 2, Moreton Bay Regional Council"

Aurecon, July 2010, “Data Standard - Bridges, Regional Floodplain Database - Stage 2, Moreton Bay Regional Council”

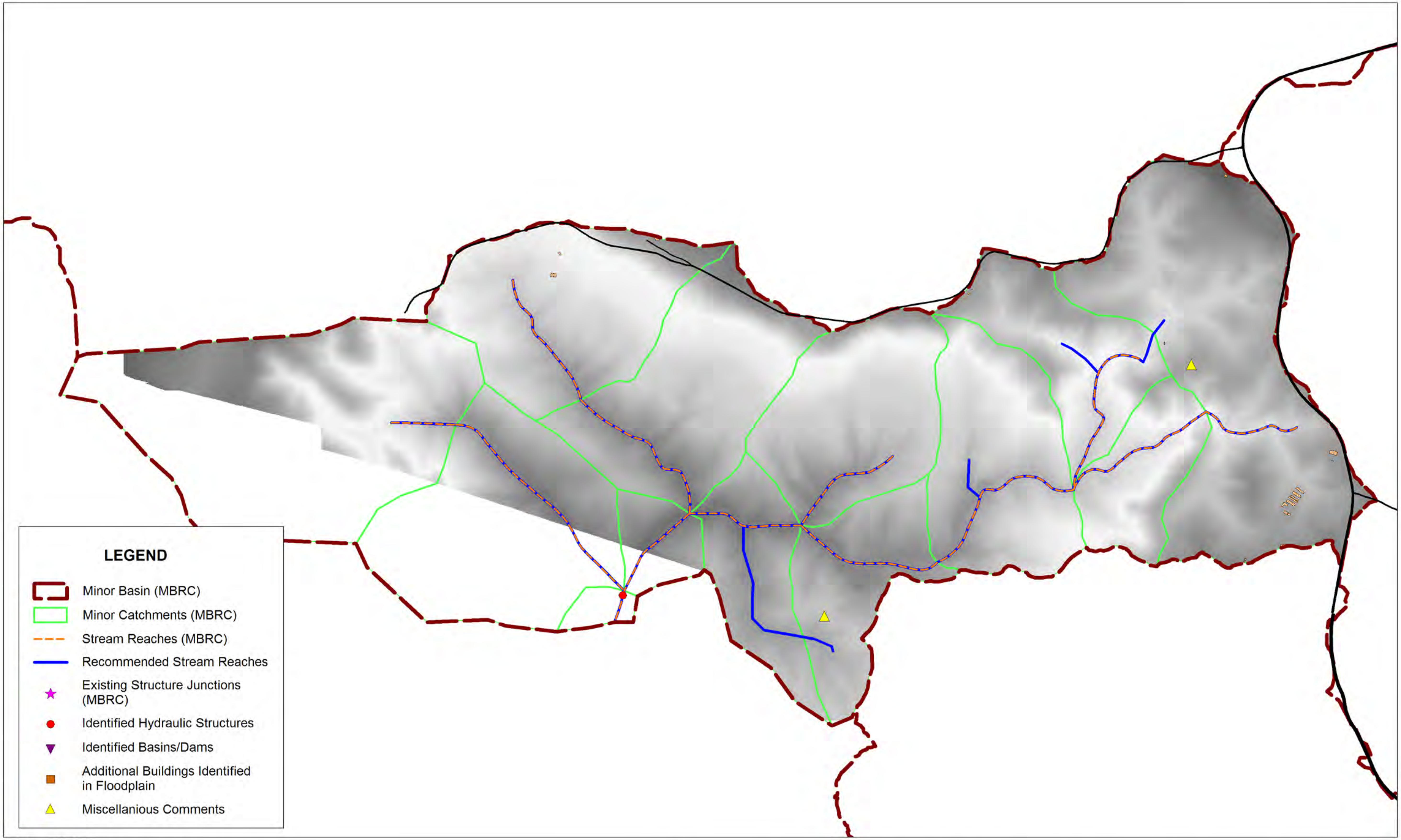
Aurecon, July 2010, “Data Standard - Detention Basins, Regional Floodplain Database - Stage 2, Moreton Bay Regional Council”

Aurecon, July 2010, “Data Standard – Trunk Underground Drainage, Regional Floodplain Database - Stage 2, Moreton Bay Regional Council”

Sargent Consulting (for the Caboolture Shire Council), March 2005, “Stanley River Flood Study Final Report”

WorleyParsons, September 2010 "Regional Floodplain Database - Floodplain Terrain"

Appendix 1 - Data Review Figures



All data supplied by MBRC.
Additional_Comments, Additional_Hydraulic_Structures, Additional_Bulidings, Additional_DamsBasins and MAR_Reach_Mod supplied by WorleyParsons on the 14/10/10

NOT TO SCALE

Rev	Date	Revision Description	ORIG	CHK	ENG	APPD
0	14/10/2010	Issued for use	RS	JM	RS	KH

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REGIONAL FLOODPLAIN DATABASE PROJECT

FIGURE 1
BYRON CREEK DATA REVIEW

Project No: 301001-01156 | Figure: 301001-01156-EN-DAL-0001 | Rev: 0

Compiled by SUNSHINE COAST INFRASTRUCTURE GIS SECTION

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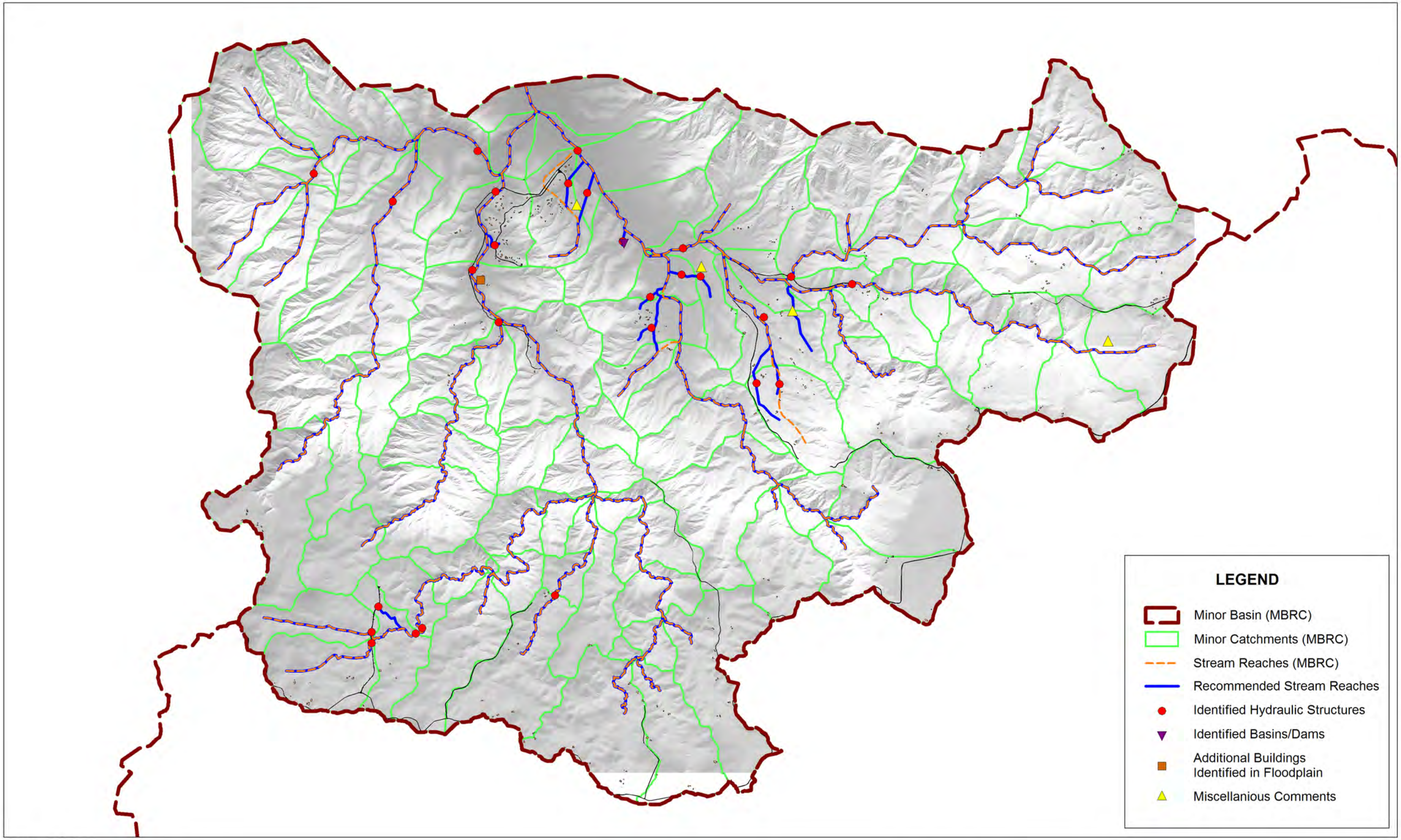

All data supplied by MBRC.
Additional_Comments, Additional_Hydraulic_Structures, Additional_Bulidings, Additional_DamsBasins and MAR_Reach_Mod supplied by WorleyParsons on the 5/10/10

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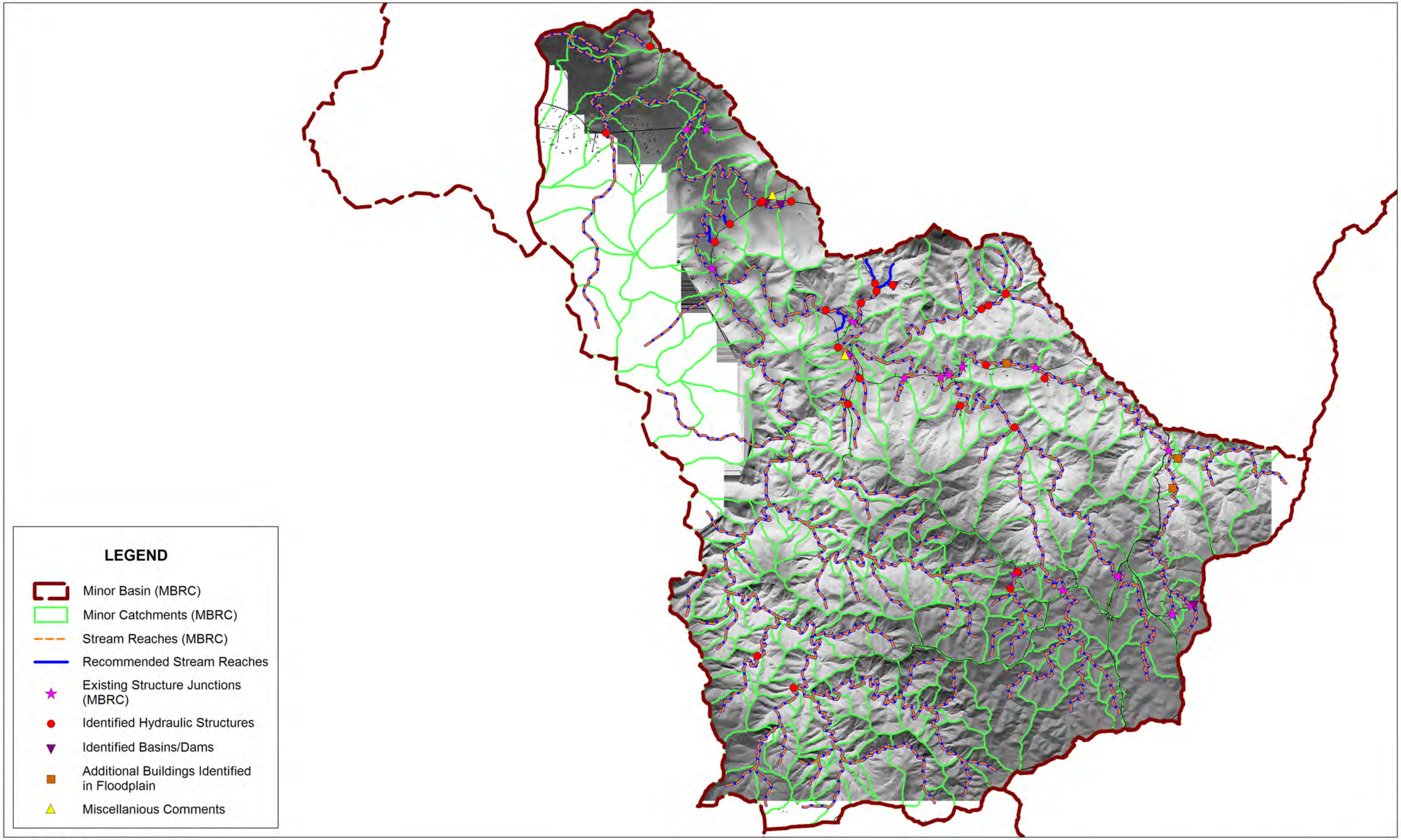
REGIONAL FLOODPLAIN DATABASE PROJECT

FIGURE 2
MARY RIVER DATA REVIEW

Project No: 301001-01156 | Figure: 301001-01156-EN-DAL-0002 | Rev: 0



All data supplied by MBRC.
Additional_Comments, Additional_Hydraulic_Structures, Additional_Bulidings, Additional_DamsBasins and MAR_Reach_Mod supplied by WorleyParsons on the 14/10/10

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0	14/10/2010	Issued for use	RS	JM	RS	KH

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FIGURE 3
NEURUM CREEK DATA REVIEW

Project No: 301001-01156 | Figure: 301001-01156-EN-DAL-0003 | Rev: 0

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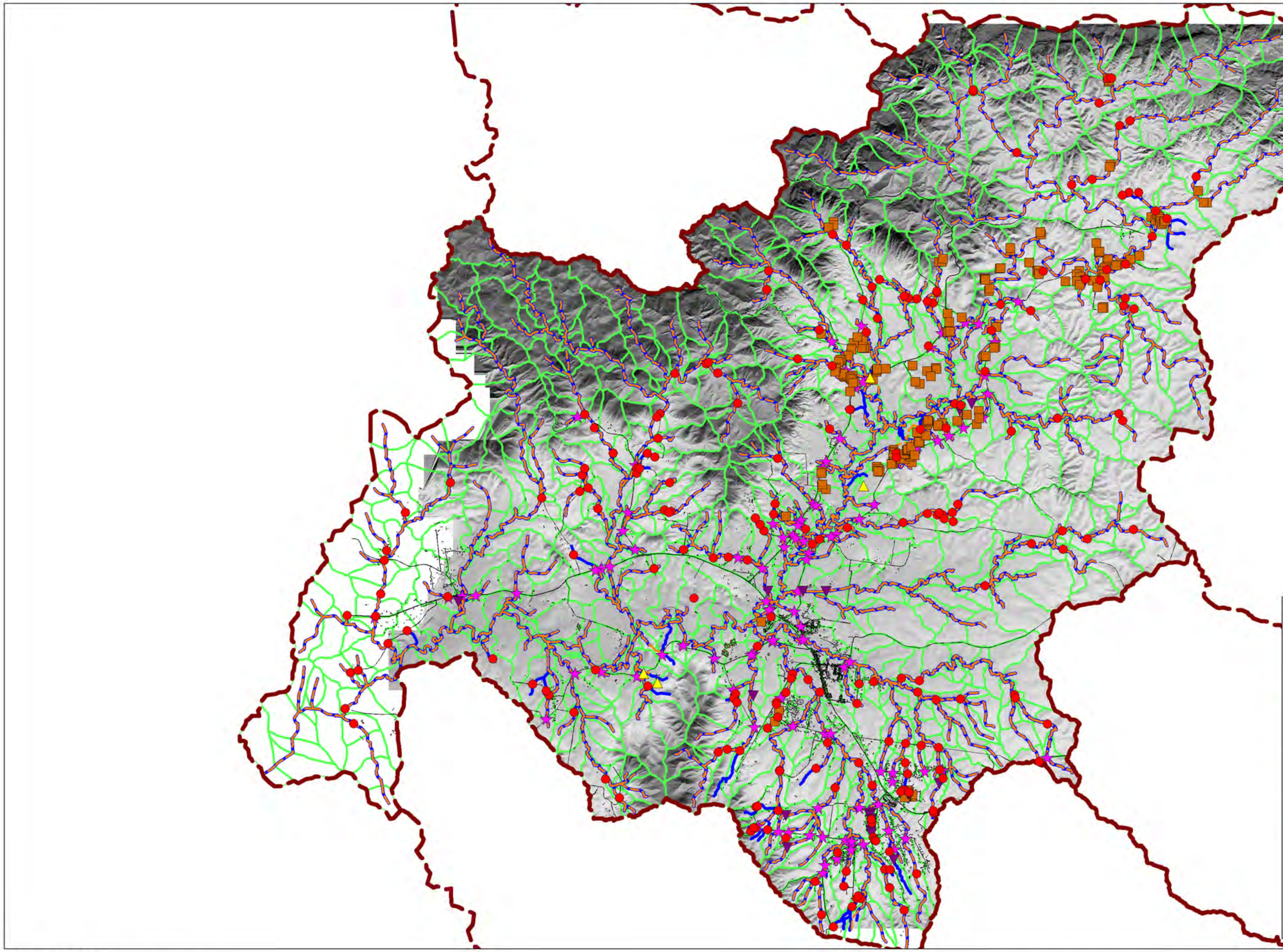

LEGEND

Minor Basin (MBRC)
Minor Catchments (MBRC)
Stream Reaches (MBRC)
Recommended Stream Reaches
Existing Structure Junctions (MBRC)
Identified Hydraulic Structures
Identified Basins/Dams
Additional Buildings Identified in Floodplain
Miscellanious Comments

All data supplied by MBRC.
Additional_Comments, Additional_Hydraulic_Structures, Additional_Bulidings, Additional_DamsBasins and MAR_Reach_Mod supplied by WorleyParsons on the 14/10/10

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REGIONAL FLOODPLAIN DATABASE PROJECT

FIGURE 4
STANLEY RIVER DATA REVIEW

Project No: 301001-01156 | Figure: 301001-01156-EN-DAL-0004 | Rev: 0

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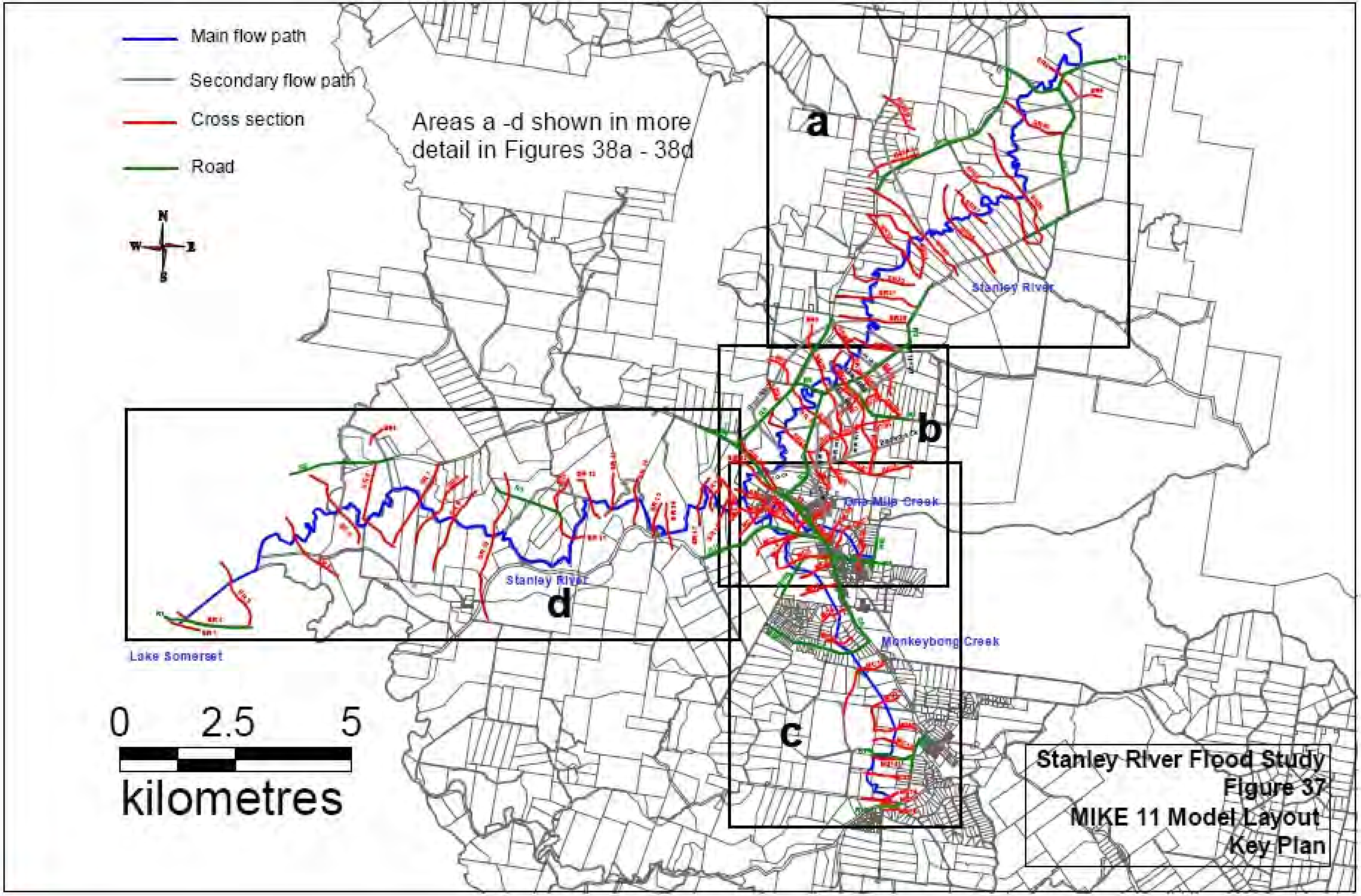
Appendix 2 - Stanley River 2003 MIKE 11 Model Layout


Main flow path
Secondary flow path
Cross section
Road
Areas a -d shown in more detail in Figures 38a - 38d
N
W
E
S
a
b
c
d
Stanley River
One Mile Creek
Monkeybong Creek
Lake Somerset
0
2.5
5
kilometres
Stanley River Flood Study
Figure 37
MIKE 11 Model Layout
Key Plan

APPENDIX B: HYDROGRAPHY REVIEW REPORT

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Hydrography Review Report

Package 5

301001-01156 – EN-REP-0006

16 November 2010

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HYDROGRAPHY REVIEW REPORT
PACKAGE 5

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PROJECT 301001-01156 - HYDROGRAPHY REVIEW REPORT

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for Internal Review	R.Stewart	K.Hegerty		16-Nov-10	N/A	
0	Issue for Use	R.Stewart	K.Hegerty	L.Stalley	16-Nov-10		

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CONTENTS

1. INTRODUCTION

WorleyParsons Services Pty Ltd has been engaged by Moreton Bay Regional Council (MBRC) to carry out detailed surface water modelling over four of the regional catchments in their Local Government Area (LGA). The four catchments are Stanley River (STA), Neurum Creek (NEU), Mary River (MAR) and Byron Creek (BYR). These make up 'Package 5' of MBRC's Regional Floodplain Database Project (RFD Project) and are referred to as 'minor basins' in the GIS data provided by MBRC.

At the commencement of this project MBRC handed over an extensive data set including established 'broadscale' models (including associated results and reporting) as well as their established hydrography layer. The hydrography data provided by MBRC includes their previously established stream reaches, stream junctions, major basins, minor basins, major catchments and minor catchments. An overland flowpath layer has also been provided for the Mary River catchment.

WorleyParsons has reviewed the supplied hydrography data against other data provided for the project including aerial imagery and a 2.5m grid aerial LiDAR digital elevation model. Based on this review, we have identified issues and where necessary we have made recommendations to improve the suitability of the hydrography for use in the current detailed modelling project.

2. HYDROGRAPHY REVIEW

2.1 Issues Identified During Stage 1

2.1.1 Byron Creek

Byron Creek was not included in the Stage 1 broadscale modelling hence no issues have previously been identified.

2.1.2 Mary River

Recommendations from Stage 1 are as follows:

'The upper sub-catchments are relatively elongated and due to the application of the inflows at the lowest or wet cells (within the 2d_sa polygon), accurate flood information may not be provided in the upper catchments. It is recommended that consideration be given to either subdividing the sub-catchments or applying portions of the sub-catchment inflows at a number of locations.'

2.1.3 Neurum Creek

Recommendations from Stage 1 are as follows:

'Due to the application of the inflows at the lowest or wet cells (within the 2d_sa polygon), accurate flood information may not be provided in the upper catchments. If Council requires more accurate flood information throughout the catchment, it is recommended that the sub-catchments be subdivided or portions of the sub-catchment inflows be applied at a number of locations.'

2.1.4 Stanley River

No hydrography issues where identified for the Stanley River catchment during Stage 1.

2.2 Stream Connectivity

Stream connectivity was generally found to be correct across the majority of the package 5 area. A few isolated instances have been identified where stream connectivity appears incorrect. A modified 'Stream Reaches' GIS layer has been provided reflecting WorleyParsons recommended stream connectivity.

2.3 Inclusion of Floodplain Structures

The majority of major floodplain structures have been picked up in the stream junction GIS layer provided by MBRC. Additional structures have been identified by WorleyParsons and it is recommended that these be incorporated into the MBRC hydrography stream junction layer.

2.4 Existing Resolution/Detail

The current resolution of the MBRC hydrography is considered suitable for use in the RFD project. This is on the basis that stream routing will generally be carried out hydraulically by TUFLOW as opposed to relying on WBNM hydrologic model's stream routing functionality which is calculated as a function of sub-catchment area.

The reason for this distinction is that flow attenuation occurring from channel routing may be incorrect in some instances when calculated using a function of sub-catchment area. This is due to a number of factors including sub-catchment shape, slope, and also by the hydrography including minor stream reaches (tributaries) which are located within a regional floodplain and which can artificially reduce the representative catchment size of the main channel.

3. PROPOSED CHANGES

WorleyParsons’ recommended changes to the hydrography are detailed in the GIS data provided with this report. Figures 1 to 4 in Appendix A give an overview of this data for each minor basin however due to the large extent of the study areas it is recommended that this data be reviewed using a GIS software package rather than relying on these figures.

The following GIS layers have been provided to describe our recommended changes to the hydrography layer.

1. ‘Recommended Stream Reaches’: A complete updated set of stream reaches for each minor basin based on MBRC supplied data and incorporating WorleyParsons’ suggested changes.
2. ‘Recommended Stream Junctions’: GIS layer including additional stream junctions which should be included. These stream junctions have been incorporated along the stream reaches layer at locations where additional sub-catchments should be delineated.
3. ‘Identified Hydraulic Structure’: This is a copy of the identified hydraulic structures that were identified in WorleyParsons previous package 5 Infrastructure Data Assessment Report (14/10/2010).
4. ‘Miscellaneous Comments’: Contains comments relating to the hydrography review. Comments are generally associated with highlighting issues with catchment delineation.

It is proposed that MBRC utilise WorleyParsons’ GIS data layers to update the package 5 hydrography. Additional catchments should be delineated along the recommended stream reaches layer at points contained within the recommended stream junctions layer and also the identified hydraulic structure layer.

The location of the additional stream junctions have been chosen based on several factors including:

1. To provide additional catchment break down in the upper catchments to reduce potential inaccuracies identified in the previous stage 1 broadscale modelling.
2. To provide increased sub-catchment resolution where appropriate.
3. To improve sub-catchment shape and length.
4. Stream junctions have also been put at new stream confluences in the recommended stream reaches layer.

4. RECOMMENDATIONS

It is recommended that MBRC update the package 5 hydrography based on the proposed changes discussed in this report and detailed in the supplied GIS data.

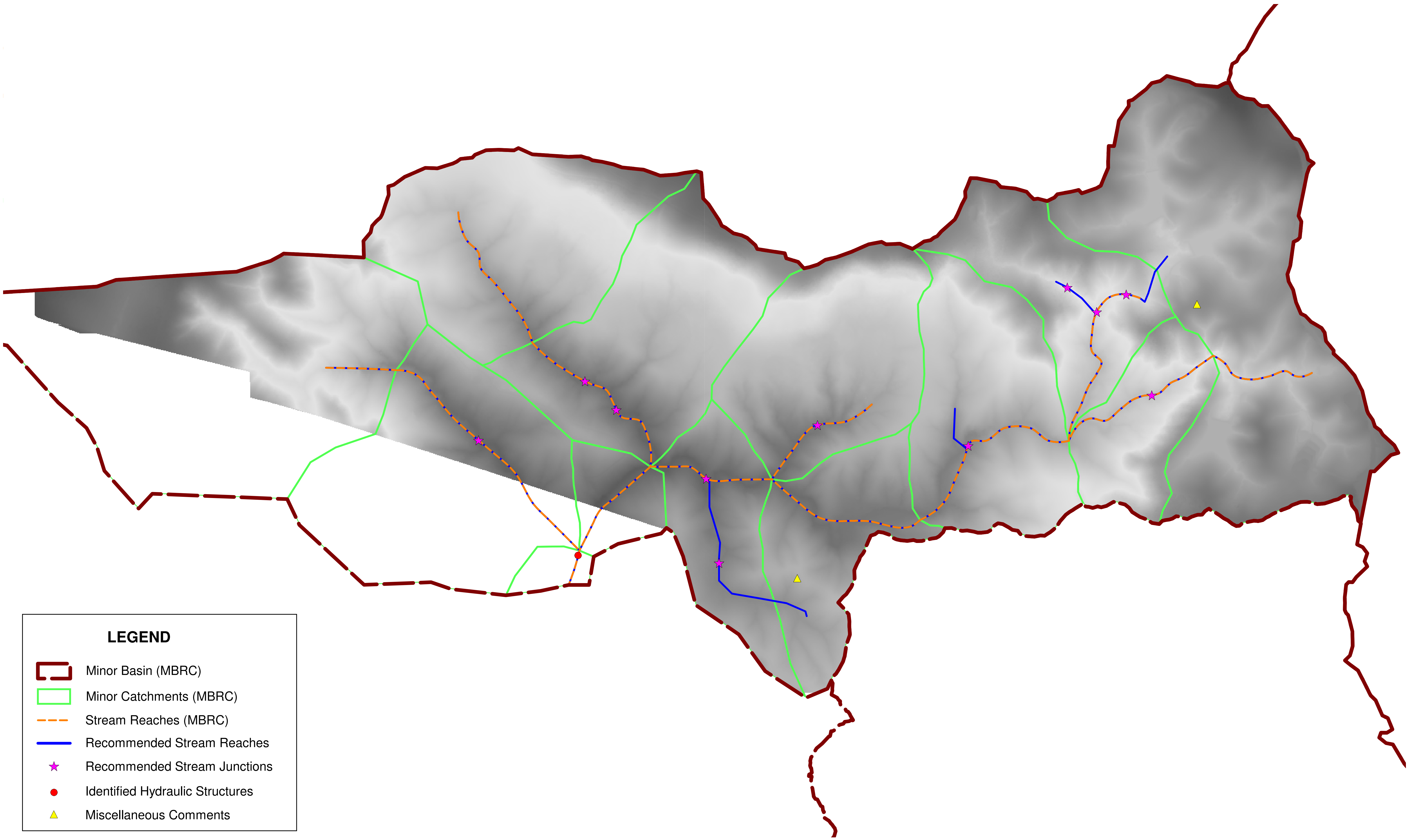
5. REFERENCES

BMT WBM, July 2010, *"Hydraulic Modelling (Broadscale) Regional Floodplain Database Stage 1 Sub-Project 1D"*

WorleyParsons, September 2010 *"Regional Floodplain Database - Floodplain Terrain"*

WorleyParsons, September 2010 *"Regional Floodplain Database, Design Rainfall - Burpengary Pilot Project"*

Appendix 1 - Hydrography Review Figures



Existing hydrographic data supplied by MBRC.
Miscellaneous_Comments, Identified Hydraulic Structures, Recommended Stream Reaches, Recommended Stream Junctions supplied by WorleyParsons on the 11/11/10

NOT TO SCALE

Rev	Date	Revision Description	ORIG	CHK	ENG	APPD
0	11/11/2010	Issued for use	RS	JM	RS	ER

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FIGURE 1
BYRON CREEK HYDROGRAPHY REVIEW

Project No: 301001-01156 | Figure: 301001-01156-EN-DAL-0008 | Rev: A

Compiled by SUNSHINE COAST INFRASTRUCTURE GIS SECTION

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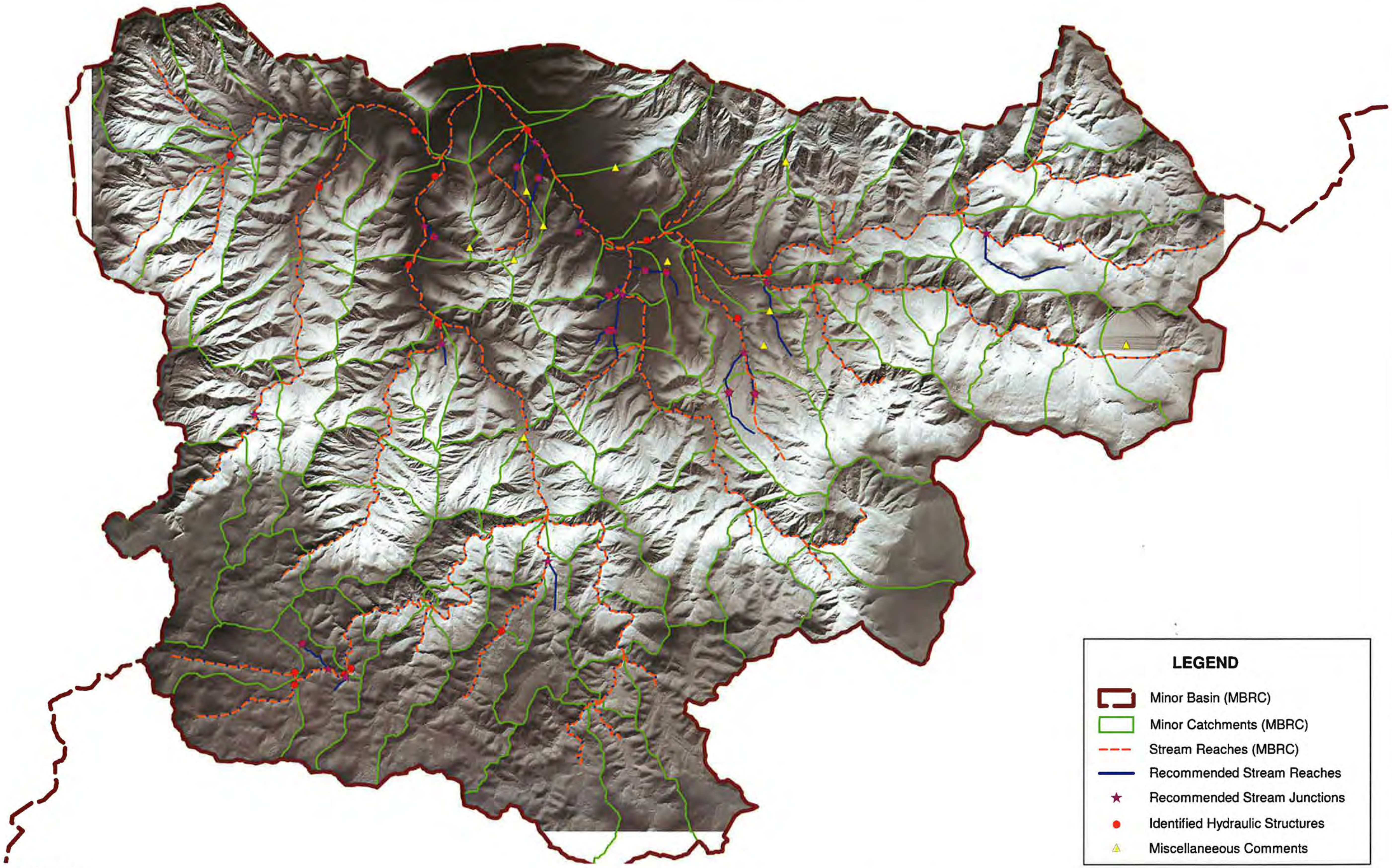

Existing hydrographic data supplied by MBRC. Miscellaneous_Comments, Identified Hydraulic Structures, Recommended Stream Reaches, Recommended Stream Junctions supplied by WorleyParsons on the 11/11/10

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Rev	Date	Revision Description	ORIG	CHK	ENG	APPD
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FIGURE 2
MARY RIVER HYDROGRAPHY REVIEW

Project No: 301001-01156 | Figure: 301001-01156-EN-DAL-0009 | Rev: A

Compiled by SUNSHINE COAST INFRASTRUCTURE GIS SECTION

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LEGEND

- Minor Basin (MBRC)
- Minor Catchments (MBRC)
- Stream Reaches (MBRC)
- Recommended Stream Reaches
- Recommended Stream Junctions
- Identified Hydraulic Structures
- Miscellaneous Comments

Existing hydrographic data supplied by MBRC.
Miscellaneous_Comments, Identified Hydraulic Structures, Recommended Stream Reaches, Recommended Stream Junctions supplied by WorleyParsons on the 11/11/10

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Rev	Date	Revision Description	ORIG	CHK	ENG	APPD
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FIGURE 3
NEURUM CREEK HYDROGRAPHY REVIEW

Project No: 301001-01156 | Figure: 301001-01156-EN-DAL-0010 | Rev: A

Compiled by SUNSHINE COAST INFRASTRUCTURE GIS SECTION

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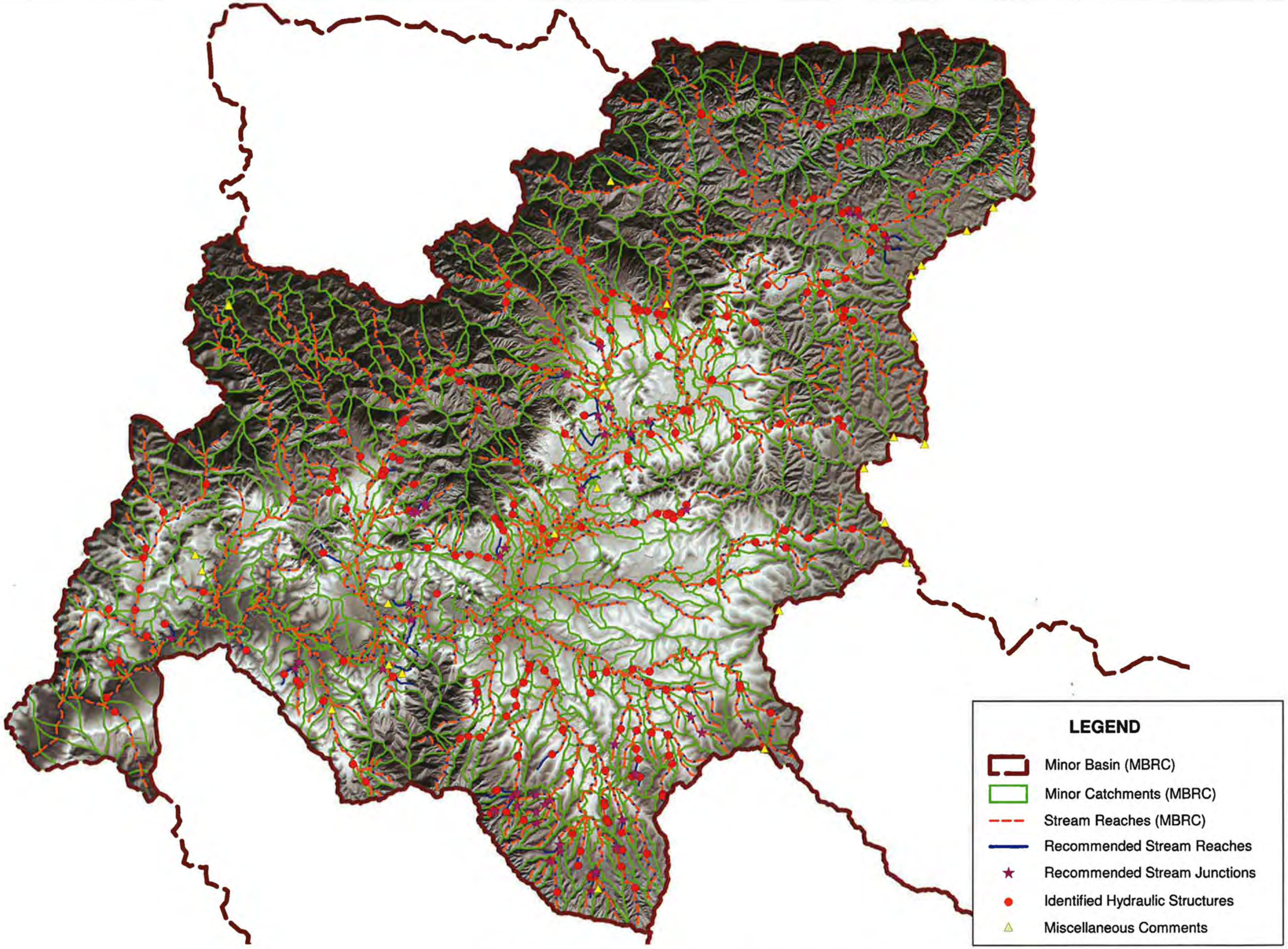

Existing hydrographic data supplied by MBRC. Miscellaneous_Comments, Identified Hydraulic Structures, Recommended Stream Reaches, Recommended Stream Junctions supplied by WorleyParsons on the 11/11/10

NOT TO SCALE

Rev	Date	Revision Description	ORIG	CHK	ENG	APPD
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REGIONAL FLOODPLAIN DATABASE PROJECT

FIGURE 4
STANLEY RIVER HYDROGRAPHY REVIEW

Project No: 301001-01156	Figure: 301001-01156-EN-DAL-0011	Rev: A

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APPENDIX C: CALIBRATION AND VALIDATION REPORTS

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Regional Floodplain Database

Stanley River (STA) Model Calibration Report

301001-01156 – 00-EN-REP-0007

9 Aug 2012

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STANLEY RIVER (STA) MODEL CALIBRATION REPORT

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PROJECT 301001-01156 - REGIONAL FLOODPLAIN DATABASE

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0	Issue for use	L Cheung	K Hegerty	M Shaw	9 Aug 2012		

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LIST OF FIGURES

1 INTRODUCTION

As part of the Moreton Bay Regional Council (MBRC) Regional Flood Database (RFD) Stage 2, a model calibration and validation to two (2) historical flood events has been undertaken for the Stanley River (STA) minor basin.

The January 2011and February 1999 historic flood events were selected by MBRC for this purpose. The January 2011 event was selected for the model calibration due to the flood event being the largest flood on record within the Stanley River catchment. The February 1999 event was chosen for model validation for consistency with other catchments included in the RFD.

Model calibration is an important process of developing a flood model. Model calibration also helps to understand the resolution, accuracy and potential limitations of the model. The model calibration is therefore an important step in the development of the RFD. MBRC is aware of the importance of model calibration, in particular when utilising the models to assess future development and for community consultation. Council has therefore paid great attention to the model calibration phase of the project. Based on available rainfall, river gauge and flood mark data, model calibration was considered to be feasible and subsequently commissioned in the following four (4) minor basins as part of the RFD:

- Burpengary Creek (pilot study);
- Caboolture River (CAB);
- Stanley River (STA); and
- Upper Pine River (UPR).

This report outlines the data used, results and discussion of the model calibration for the STA minor basin.

2 JANUARY 2011 CALIBRATION EVENT

2.1 Rainfall Data

Recorded rainfall data has been obtained from 11 gauging stations operated by MBRC or Bureau of Meteorology (BOM) for the period between 6th – 12th January 2011 for the purposes of model calibration. Details of the rainfall gauges are summarised in Table 1. Location of the rainfall gauges are presented on Figure 1.

Table 1 January 2011 Event Rainfall Gauge Details

Gauge ID	Easting	Northing	Total Rainfall Depth (mm)	Source
Hume Lane AL	489568	7031071	748	MBRC Data
Kilcoy AL	458707	7019245	424	MBRC Data
Mt Mee Alert-P	478186	7005826	682	MBRC Data
Wamuran AL	486116	7008263	754	MBRC Data
Woodford Alert-P	476175	7020376	592	MBRC Data
Maleny	484838	7039794	827	BoM Data
Bald Knob	491580	7038050	644	BoM Data
Landsborough	495806	7035228	713	BoM Data
Harper Creek	477352	7039661	667	BoM Data
West Bellthorpe	468003	7033095	695	BoM Data
Ferris Knob	481820	7029700	711	BoM Data

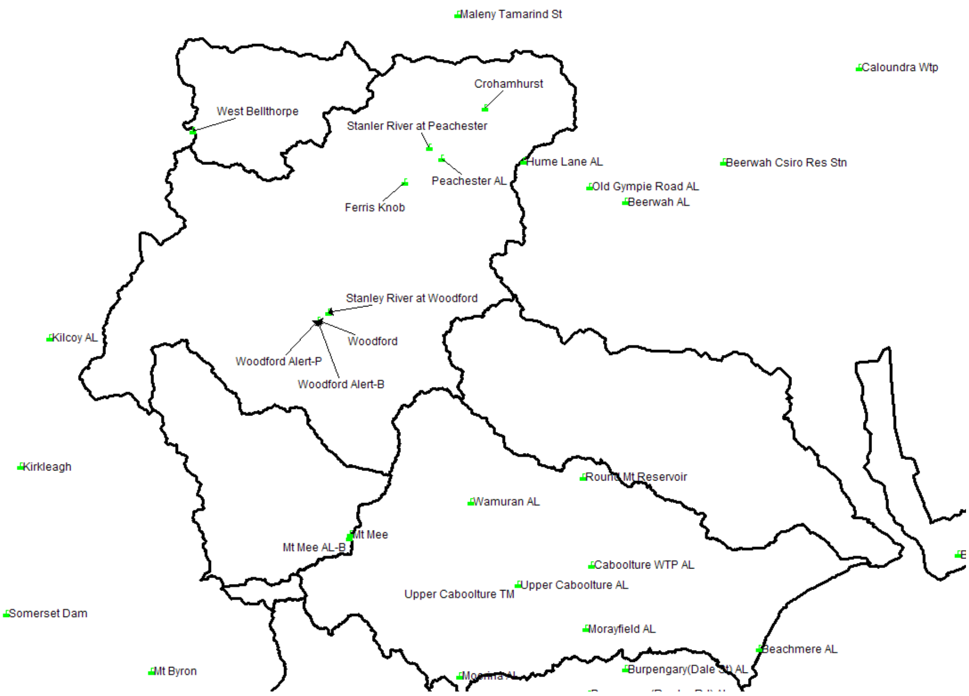


Figure 1 Rainfall Gauge Locations

Analysis of the recorded rainfall data between the 6th and 12th of January 2011 suggest a similar trend in the timing of rainfall bursts over the Stanley River catchment during the 6 day rainfall recorded period. It is noted that the magnitude of the total rainfall depths over the north-eastern part of the catchment is higher than the south-western part during the model calibration period. Cumulative rainfall depths range from approximately 600 to 800mm over the north-eastern part of the catchment and gradually decrease to the range from 400 to 600mm towards the southwest. The recorded cumulative rainfall depths for these rainfall gauges are illustrated on Figure 2.

.

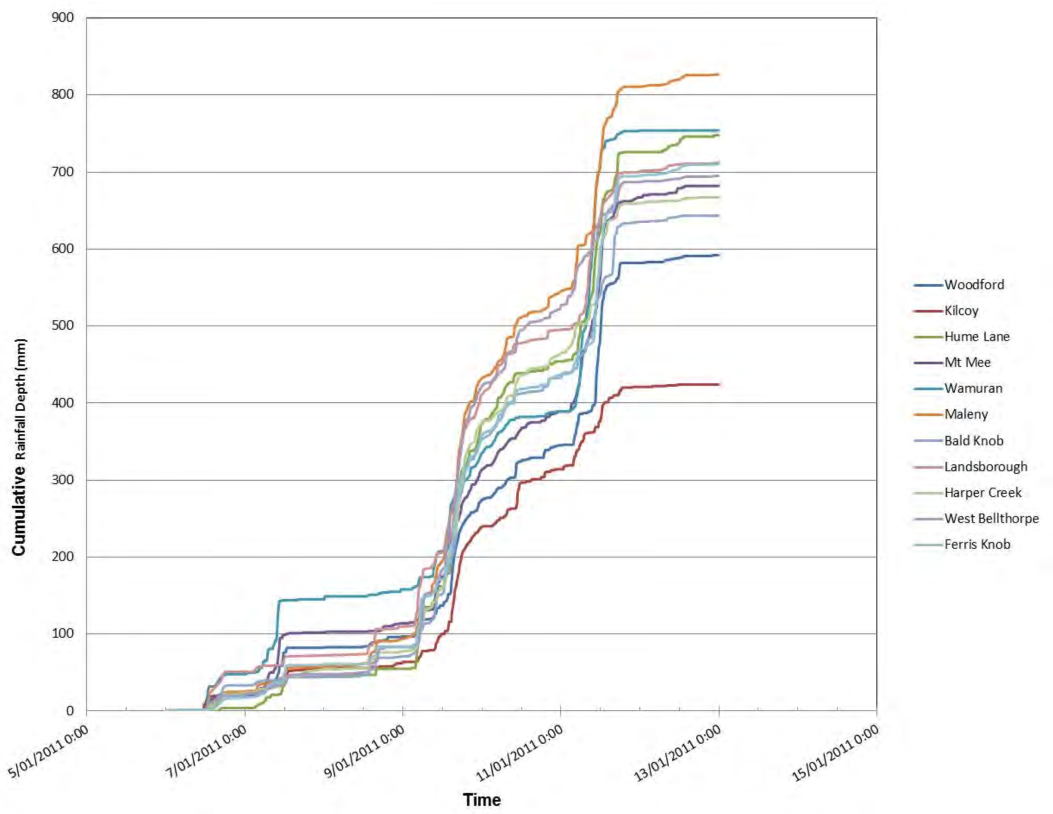


Figure 2 Cumulative Rainfall Depths – January 2011 Event

2.2 Modelling

2.2.1 Hydrologic Model

The hydrologic WBNM model was developed using 5 minute interval rainfall from the 11 rainfall gauges described in Section 2.1. Sub-catchment information was based on the hydrography (sub-catchment delineation) adopted by Council. The default values for the setup were used for most of the WBNM parameters (i.e. nonlinearity exponent, stream routing). The ultimate rainfall loss and model lag parameters adopted for the STA WBNM calibration model are summarised in Table 2 .

Table 2 Rainfall Loss and Model Lag Parameters

Loss Parameters		Sub-area Lag Parameter
Initial	Continuing	
0mm	2.5mm/hour	1.6

2.2.2 Hydraulic model

The hydraulic model used for this assessment has a cell size of 10m grid resolution, compared to the 5m grid model developed for modelling the minor to large design events. The increase in cell size from 5m to 10m grid was to avoid the excessive model run times for simulation of the 6 day rainfall for the January 2011 event.

As part of the model calibration assessment various hydraulic models were setup and simulated utilising the inflows derived from the WBNM hydrologic modelling. The downstream boundary of STA model is located near the top of Lake Somerset; therefore, the gate operations at the dam will control water levels in the lake and the outflow of the STA model. The peak Lake Somerset level at 105 mAHD during the January 2011 event has been adopted for the STA calibration model run.

The initial run of the January 2011 event was undertaken using the parameters obtained from the Burpengary Pilot Project. A number of iteration runs for various model scenarios following the initial run has been undertaken for the determination of the final model input parameters including a set of depth varying Manning's 'n' values to represent the hydraulic roughness for the dense, medium dense and low grass grazing vegetation landuse profiles for the STA minor basin.

The results of the January 2011 calibration run using the final adopted parameters are discussed below.

2.2.3 January 2011 Results

MBRC has provided surveyed flood mark levels collected from 37 locations for the January 2011 events. In addition, stage hydrographs were obtained from the Peachester and Woodford ALERT flood warning stations in the upper and middle reaches of the Stanley River for the January 2011 event.

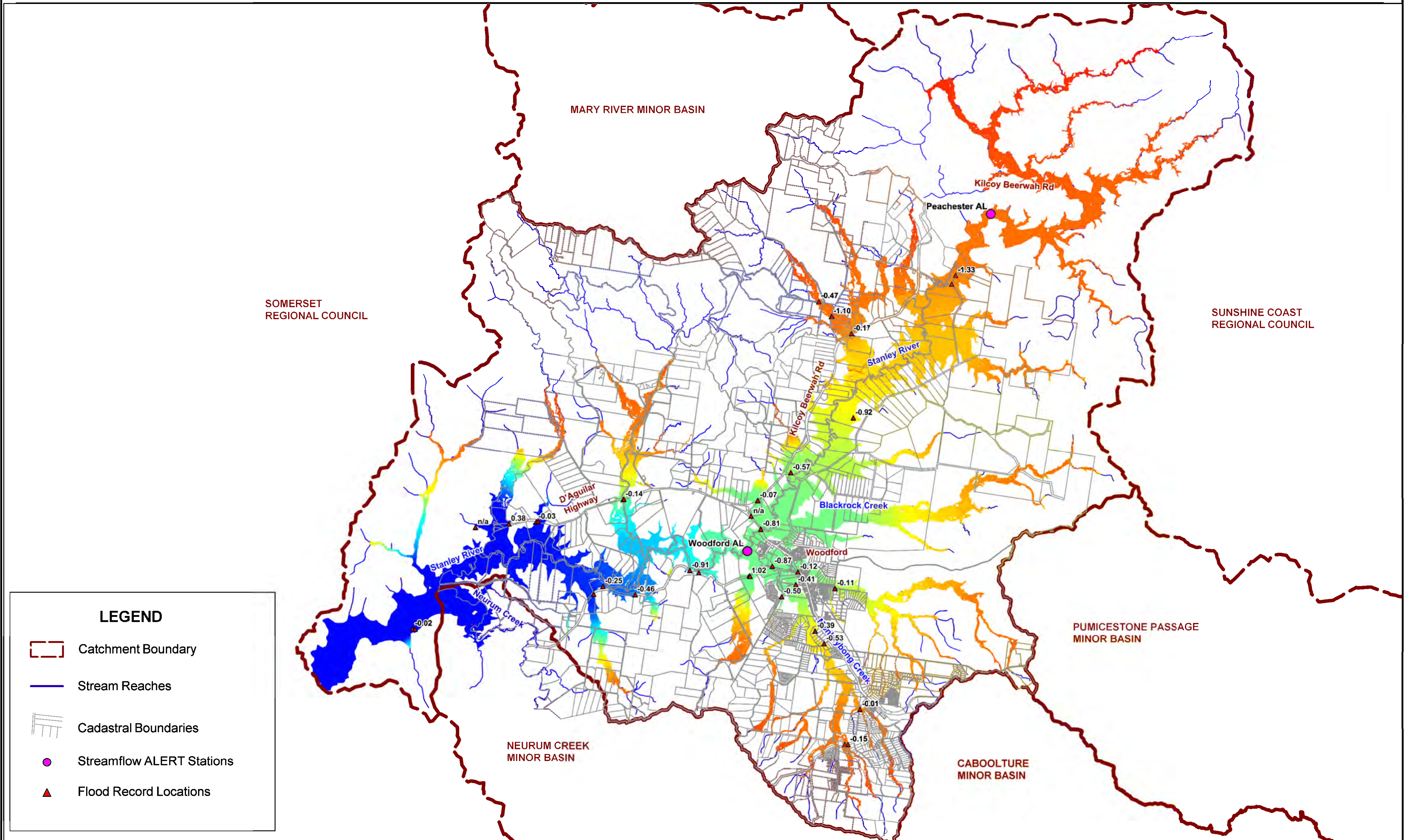
2.2.3.1 Flood Mark Comparison

Among the 37 flood marks for within the STA minor basin; 4 of them were categorised as being of high quality, 32 being of medium quality and the remaining 1 being low quality. The flood level heights at the flood mark locations were surveyed by Council following the January 2011 event. Two of the 37 flood marks were located outside the modelled flood extent.

The surveyed flood levels at the flood marks were compared to the modelled peak flood levels derived from the calibration model. The distributions of modelled differences are summarised in Table 3. The table shows that the modelled peak flood levels were generally under-estimated with the median difference being -374mm and the range extending from -1,326mm to 1,504mm. The differences distributions are approximately 30% of modelled levels are within ±200mm and 40% of modelled levels are within ±300mm for the January 2011 event. The spatial results of the January 2011 calibration run are presented on Figure 3. A histogram showing the difference in flood levels versus the number of flood marks is presented in Figure 4.

Table 3 Summary of Modelled Differences in Peak Flood Levels

Parameter	January 2011
Average (mm)	-321
Median (mm)	-374
Maximum (mm)	1504
Minimum (mm)	-1326
No. within Range >1.0m	2
No. within Range 0.5m, 1.0m	-
No. within Range 0.4m, 0.5m	-
No. within Range 0.3m, 0.4m	1
No. within Range 0.2m, 0.3m	-
No. within Range 0.1m, 0.2m	-
No. within Range 0.0m, 0.1m	-
No. within Range -0.1m, 0.0m	4
No. within Range -0.2m, -0.1m	7
No. within Range -0.3m, -0.2m	3
No. within Range -0.4m, -0.3m	2
No. within Range -0.5m, -0.4m	5
No. within Range -1.0m, -0.5m	9
No. within Range <-1.0m	2



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Latitude / Longitude
Geocentric Datum of Australia 1994

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Rev	Date	Revision Description	ORIG	CHK	ENG	QA	APPD
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REGIONAL FLOODPLAIN DATABASE PROJECT (STAGE 2)
STANLEY RIVER MODEL CALIBRATION
FIGURE 3 - FLOOD LEVEL COMPARISON
(MODELLED - MEASURED)
JANUARY 2011 EVENT

Project No: 301001-01156 | Figure:301001-01156-EN-DAL-0048 | Rev: 0

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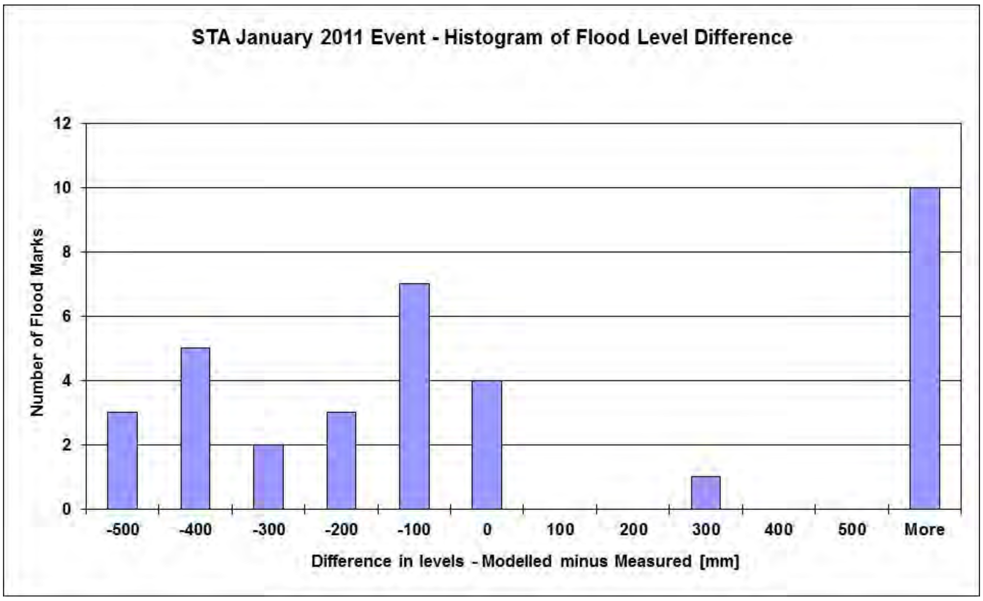


Figure 4 Flood Level Comparison Histogram

As discussed above, the modelled results are generally lower than the recorded levels, especially over the floodplain in the middle reach of the Stanley River. Some flood marks differ significantly between the surveyed and the modelled level (between +/- 1m). The anomalies are likely due to:

- The difference in the source of the levels (usage of the LiDAR versus ground survey undertaken to collect flood marks); and
- Council used a number of different survey teams to collect the flood mark data. The interpretation of flood marks/peak flood levels may have varied amongst the survey teams.

2.2.3.2 Stage Hydrograph Comparison

Comparisons of modelled and recorded stage hydrographs for the January 2011 event are presented on Figure 5 and Figure 6. The hydrograph plots show good agreement with timing at Peachester gauge, with the modelled at Woodford gauge being marginally early.

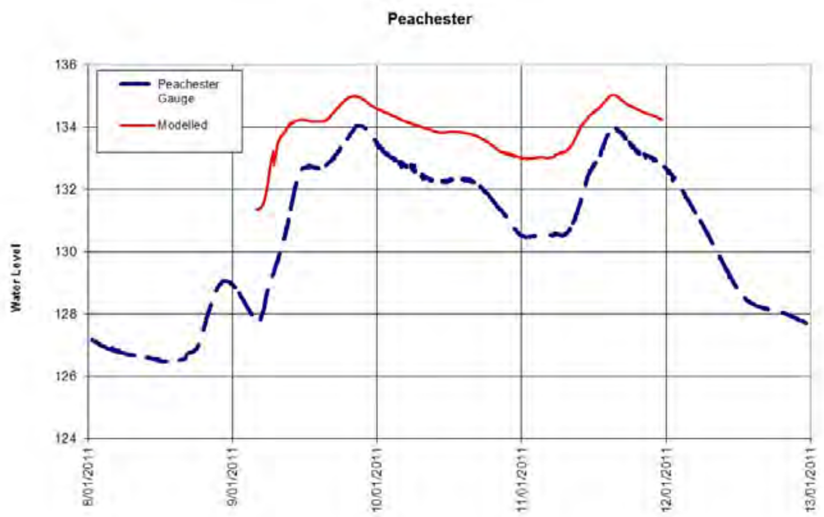


Figure 5 Comparison of Stage Hydrographs – Peachester Gauge January 2011 Event

Figure 6 Comparison of Stage Hydrographs – Woodford Gauge January 2011 Event

3 FEBRUARY 1999 VALIDATION EVENT

3.1 Rainfall Data

Recorded rainfall data has been obtained from 6 gauging stations operated by MBRC or Bureau of Meteorology (BOM) for the period between 7th – 10th February 1999 for the purposes of model validation. Details of the rainfall gauges are summarised in Table 4. Location of the rainfall gauges are presented on Figure 1.

Table 4 February 1999 Event Rainfall Gauge Details

Gauge ID	Easting	Northing	Total Rainfall Depth (mm)	Source
Kilcoy AL	458707	7019245	332	MBRC Data
Mt Mee Alert-P	478186	7005826	513	MBRC Data
Woodford Alert-P	476175	7020376	382	MBRC Data
Bald Knob	491580	7038050	450	BoM Data
West Bellthorpe	468003	7033095	497	BoM Data
Ferris Knob	481820	7029700	505	BoM Data

Analysis of the recorded rainfall data between the 7th and 10th of February 1999 suggest a similar trend in the timing of rainfall bursts over the Stanley River catchment during the 3 day rainfall recorded period. Cumulative rainfall depths range from approximately 330 to 500mm and is distributed evenly across the STA minor basin. The recorded cumulative rainfall depths for these rainfall gauges are illustrated on Figure 7.

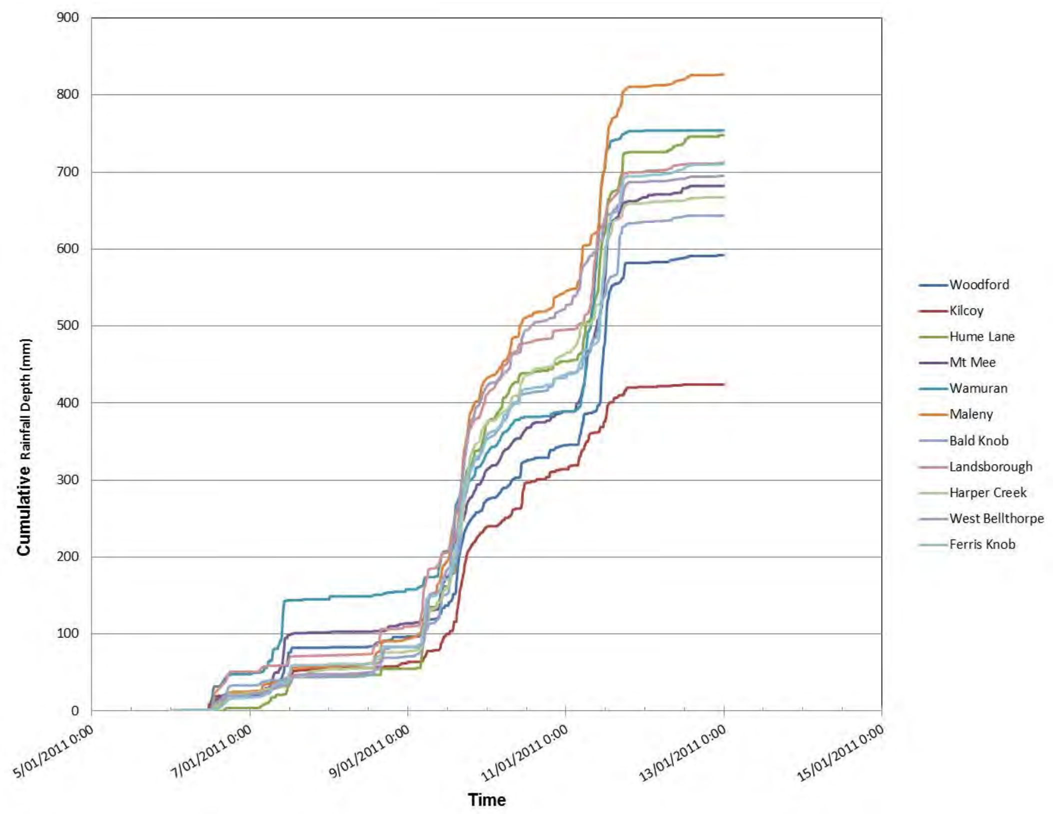


Figure 7 Cumulative Rainfall Depths – February 1999 Event

3.2 Modelling

3.2.1 Hydrologic Model

The adopted model calibration parameters from the January 2011 event have been applied to the WBNM hydrologic model to calculate inflow hydrographs for the February 1999 model validation run.

3.2.2 Hydraulic model

The adopted model parameters from the January 2011 event have been applied to the February 1999 model validation run.

The peak Lake Somerset level at 103.3 mAHD was adopted as the downstream boundary of STA model for the February 1999 run.

3.2.3 February 1999 Results

MBRC provided surveyed flood mark levels collected from 34 locations for the February 1999 event. In addition, stage hydrographs were obtained from the Peachester flood warning station in the upper reach of the Stanley River for the February 1999 event.

3.2.3.1 Flood Mark Comparison

All 34 flood marks were categorised as being medium quality. The flood level height at these flood mark locations were surveyed by Council following the February 1999 event.

The surveyed flood levels at the flood marks were compared to the modelled peak flood levels derived from the validation model. The distributions of modelled differences are summarised in Table 5. The table shows that the modelled peak flood levels were generally under-estimated with the median difference being -374mm and the range extending from -1,207mm to 454mm. The differences distributions are approximately 30% of modelled levels are within ±200mm and 40% of modelled levels are within ±300mm for the February 1999 event. A histogram showing the difference in flood levels versus the number of flood marks is presented in Figure 8. The spatial results of the February 1999 validation run are presented on .

Table 5 Summary of Modelled Differences in Peak Flood Levels

Parameter	February 1999
Average (mm)	-269
Median (mm)	-207
Maximum (mm)	454
Minimum (mm)	-1207
No. within Range >1.0m	-
No. within Range 0.5m, 1.0m	-
No. within Range 0.4m, 0.5m	1
No. within Range 0.3m, 0.4m	2
No. within Range 0.2m, 0.3m	1
No. within Range 0.1m, 0.2m	2
No. within Range 0.0m, 0.1m	4
No. within Range -0.1m, 0.0m	2
No. within Range -0.2m, -0.1m	3

Parameter	February 1999
No. within Range -0.3m, -0.2m	2
No. within Range -0.4m, -0.3m	3
No. within Range -0.5m, -0.4m	3
No. within Range -1.0m, -0.5m	5
No. within Range <-1.0m	5

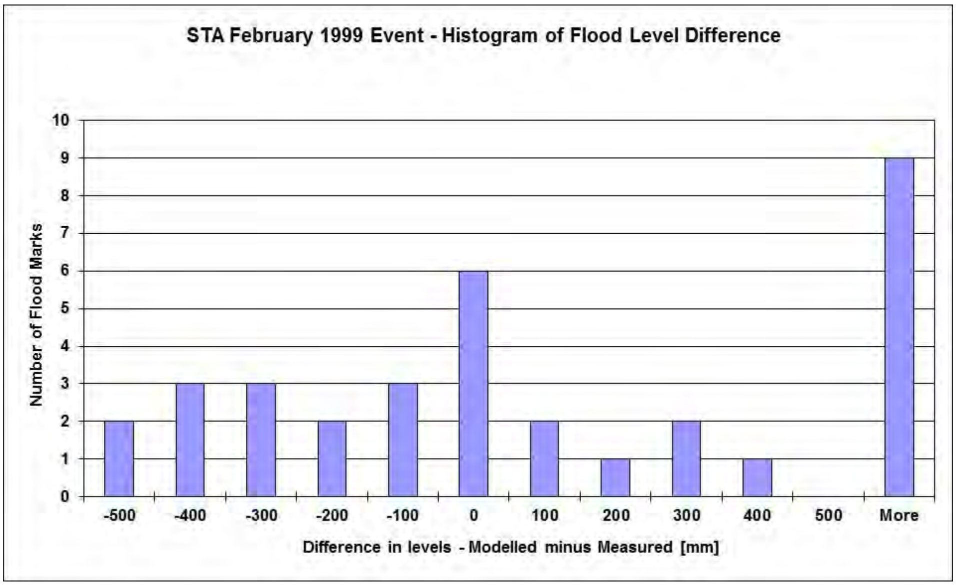
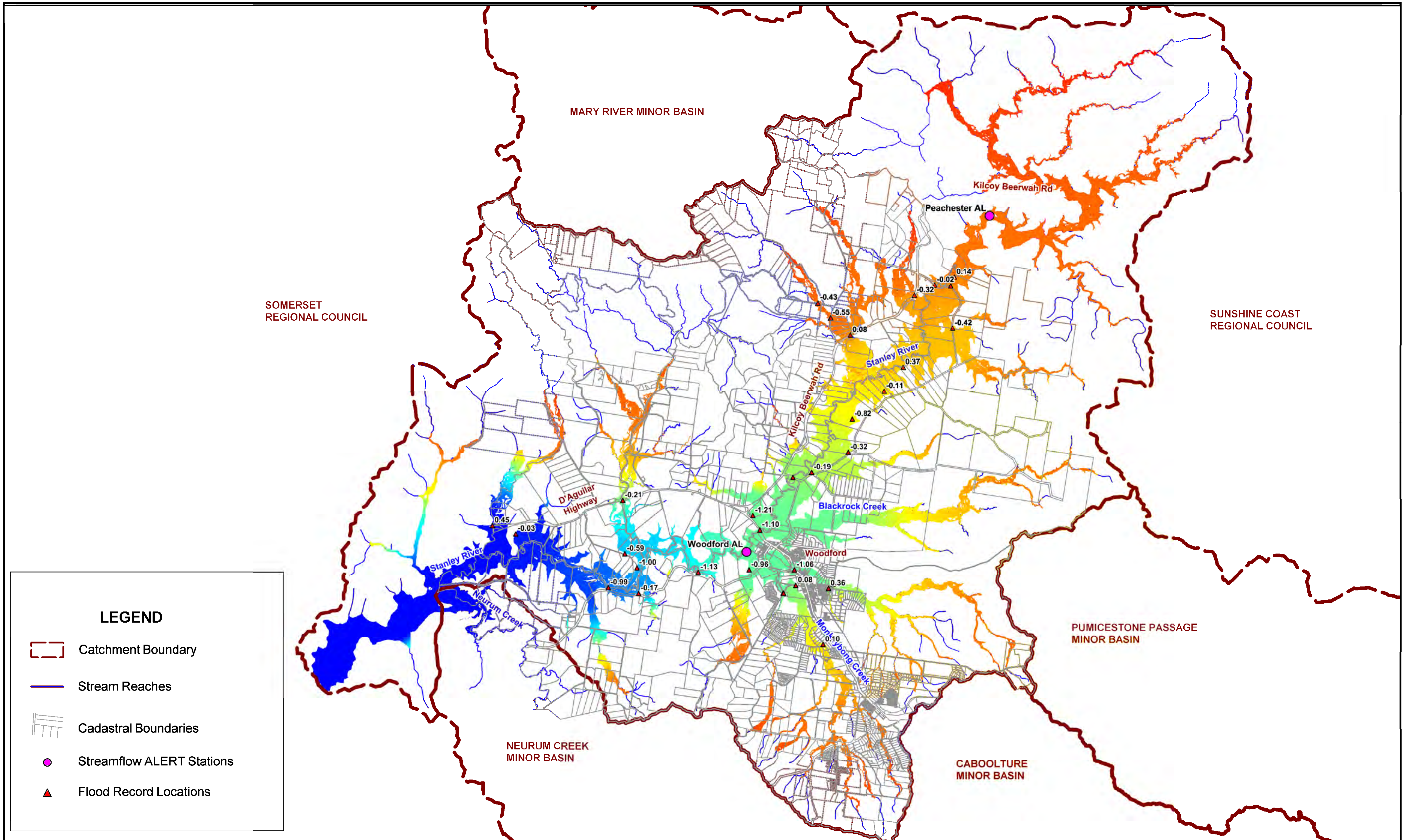


Figure 8 Flood Level Comparison Histogram

As discussed above, the modelled results are generally lower than the recorded levels, especially over the floodplain at the middle reach of Stanley River, similar to the January 2011 calibration event. Some flood marks differ significantly between the surveyed and the modelled level (between +/- 1m). As discussed above, the causes of the anomalies are likely the same as the January 2011 event due to:

- The difference in the source of the levels (usage of the LiDAR versus ground survey undertaken to collect flood marks); and
- Council used a number of different survey teams to collect the flood mark data. The interpretation of flood marks/peak flood levels may have varied amongst the survey teams.



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Latitude / Longitude
Geocentric Datum of Australia 1994

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REGIONAL FLOODPLAIN DATABASE PROJECT (STAGE 2)
STANLEY RIVER MODEL VALIDATION
FIGURE 9 - FLOOD LEVEL COMPARISON
(MODELLED - MEASURED)
FEBRUARY 1999 EVENT

Project No: 301001-01156 | Figure:301001-01156-EN-DAL-0049 | Rev: 0

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3.2.3.2 STAGE HYDROGRAPH COMPARISON

Comparisons of modelled and recorded stage hydrographs for the February 1999 event are presented on Figure 10. The hydrograph plots show the modelled peak level is almost a meter lower than the recorded level and the duration of modelled peak is about 12 hours longer than the recorded peak. The discrepancies may be due to the quality of the recorded data. The recorded hydrograph shows some discontinuity during the peak flood period.

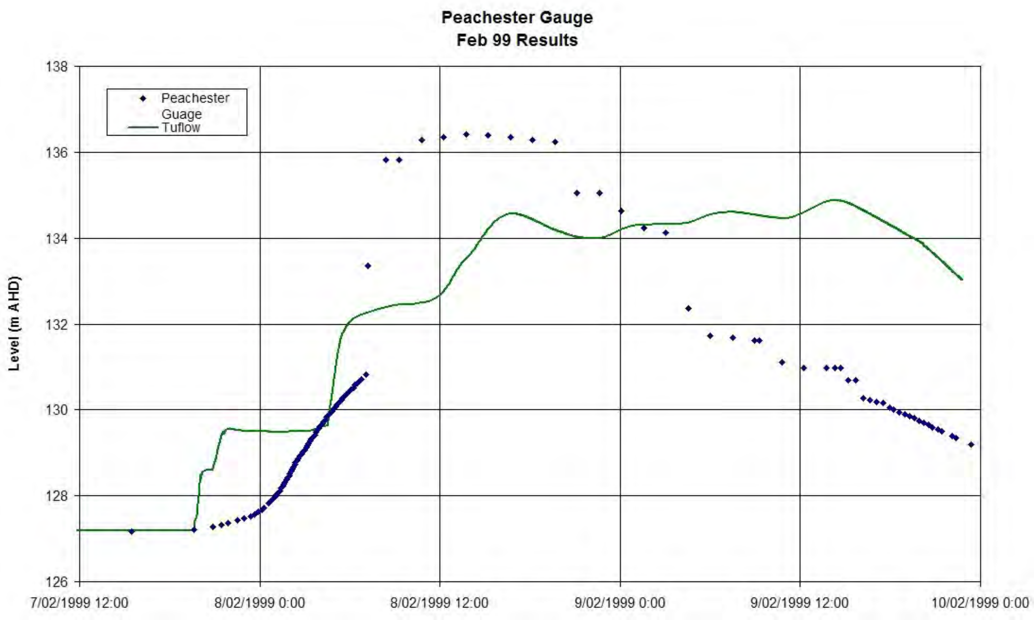

Figure 10 Comparison of Stage Hydrographs – Peachester Gauge February 1999 Event

4 DISCUSSIONS AND CONCLUSIONS

The January 2011 event used for model calibration was classified as a major event, based on BoM's classification system. The February 1999 event utilised for model validation was also classified as a major flood event at BoM's Woodford Flood ALERT flood gauge; for more details refer to the WorleyParsons (November 2010) *Calibration and Validation Feasibility Report Package 5*. These two events provide a good range of magnitude and in particular the January 2011 event occurred relatively recently, thus limiting the changes in the catchment of the landuse, additional waterway structures or change in topography.

The model calibration and validation model runs showed reasonable results, considering the two major factors of timing and peak flood levels; however it also highlighted that the peak flood levels in the middle reach were underestimated for both events. The anomalies are likely due to difference in the source of the levels (usage of the LiDAR versus ground survey undertaken to collect flood marks) and interpretation of flood marks/peak flood levels may have varied amongst the survey teams.

Localised model adjustments may have resulted in better "fit" between the measured and modelled results. However such a course of action would be counter to Council's objective for a regionally consistent model library. Localised model adjustments may also mask underlying modelling uncertainties and input data limitations. The adopted parameter set was therefore considered on-balance to be appropriate to this model. It is also noted that this decision was reached by Council having regard to similar calibration and validation exercises in adjoining catchments. These results therefore need to be considered in the context of a regional calibration approach across multiple model domains.

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Calibration and Validation Feasibility Report

Package 5

301001-01156 – EN-REP-0004

4 November 2010

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MORETON BAY REGIONAL COUNCIL
CALIBRATION AND VALIDATION FEASIBILITY REPORT
PACKAGE 5

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PROJECT 301001-01156 - CALIBRATION AND VALIDATION FEASIBILITY REPORT

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issue for Internal Review	R.Stewart	K.Hegerty		3-Nov-10	N/A	
0	Issue for Use	R.Stewart	K.Hegerty	E.Reid	4-Nov-10		

CONTENTS

MORETON BAY REGIONAL COUNCIL
CALIBRATION AND VALIDATION FEASIBILITY REPORT
PACKAGE 5

1. INTRODUCTION

WorleyParsons Services Pty Ltd has been engaged by Moreton Bay Regional Council (MBRC) to carry out detailed surface water modelling over four of the regional catchments in their Local Government Area (LGA). The four catchments are Stanley River (STA), Neurum Creek (NEU), Mary River (MAR) and Byron Creek (BYR). These catchments make up 'Package 5' of MBRC's Regional Floodplain Database Project (RFD Project) and are referred to as 'minor basins' in the GIS data provided by MBRC.

At the commencement of this project MBRC handed over an extensive data set comprising established 'broad scale' models (including associated results and reporting) as well as several sources of historic flooding information. The purpose of this report is to assess the feasibility of carrying out historic event calibration and validation for the current detailed modelling project. This assessment is based on a review of the data set provided by MBRC.

2. AVAILABLE DATA

Details of the data available for calibration and validation modelling are provided in this section. This includes data provided by MBRC as well as information obtained from websites of the Bureau of Meteorology (BoM).

The BoM operate a flood warning alert network for the upper Brisbane River which incorporates several gauges within the Package 5 area. Details of the network, including location of alert flood and rainfall gauges are provided in Appendix A for reference purposes.

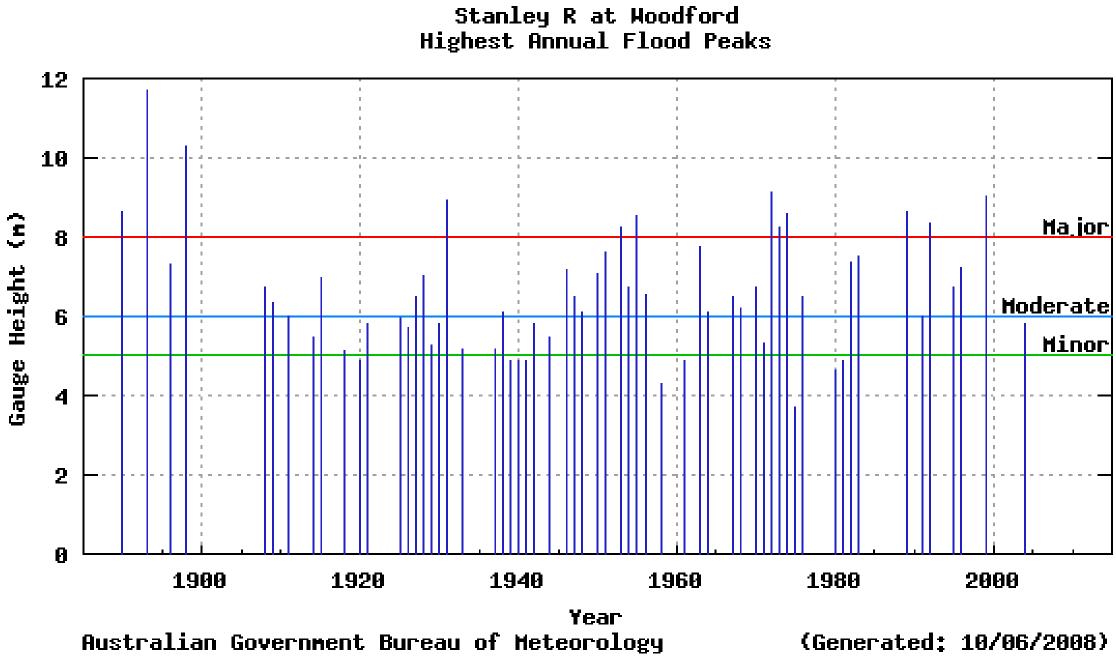
2.1 Stream Gauge Data

Stanley River has long term historic stream gauge data at Peachester and Woodford. Both of these stream gauges now incorporate telemetry and form part of the BoM's flood warning system. Details of the BoM's flood warning system are provided in Appendix A.

Hourly flow rate data has been provided for the Stanley River Peachester gauge for the period ranging from June 1927 up to April 2009.

Hourly flow rate data has been provided for the Stanley River Woodford gauge for the period ranging from February 2002 up to April 2009. This is not the complete range of data for the Stanley River which is known to extend back over 100 years. Historic flood heights at this stream gauge are shown on Figure 2.1 below. This figure is taken from the BoM's website "FLOOD WARNING SYSTEM for the UPPER BRISBANE RIVER ABOVE WIVENHOE DAM".

Figure 2.1 Stanley River Annual Flood Peaks (Source BoM)



There is no stream gauge data available for Byron Creek, Mary River or Neurum Creek (within the vicinity of the study area).

2.2 Rainfall Data

There are several historic rainfall stations with both continuous ('pluvio' or 'ALERT' data) and daily data situated in and around the package 5 minor basins. The spatial coverage of these rain gauges should allow a sufficient representation of historic rainfall patterns associated with the large weather systems which have historically generated regional flooding in the larger package 5 minor basins.

It is noted that due to the relatively small size of the Byron Creek minor basin (approx 6.8km^2), peak flooding in this catchment will be dominated by relatively short duration intense rainfall events. The inherent nature of these weather events is that they are not widespread and consequently historic flooding in Byron Creek is not likely to be well picked up by the nearest continuous rain gauge stations nearly 5km away.

We note that the MBRC supplied rainfall database does not include the pluvio data which is understood to be available from BoM for the Woodford Bcc rain gauge (dating back to 1964). The MBRC data provided is for the Woodford ALERT rain gauge only which dates back to November 1994.

We also note that only daily rainfall data is available for the Somerset Dam and the Hume Lane ALERT rain gauges in the supplied MBRC database. It is expected that some form of continuous record should also be available for these gauges from BoM.

2.3 Historic Flood Marks

A GIS layer called "OLD CAB Dist Historic Flood Levels' has been provided by MBRC. This contains recorded flood heights for 15 separate historic flood events.

There are over 110 recorded historic flood levels within the Stanley River minor basin. The two historic events populated with the most historic flood level data points are the February 1999 event and the April 1989 event. There are only two historic flood marks in the STA catchment for the May 2009 event (near Woodford).

No recorded flood level data has been provided for Byron Creek, Mary River or Neurum Creek.

2.4 Other Data

A GIS layer called "Maximum Height Indicators' has been provided by MBRC, however this data layer doesn't contain any information relevant to the Package 5 minor basins.

A GIS layer called "WQ Event Monitoring Program' has been provided by MBRC, however this data layer also doesn't contain any information relevant to the Package 5 minor basins.

It is recommended that data associated with design and historic flood levels in Somerset Dam be sourced. The reason for this is that the water level in the dam will influence flood levels in the lower Stanley River Catchment.

3. FLOOD EVENTS

3.1 Possible Events for Calibration/Validation

3.1.1 Stanley River

The following historic floods are considered the most appropriate for calibration and validation of the Stanley River catchment.

- February 1999: 373mm rainfall at Woodford over 94 hours. This flood was classified as a major flood at BoM's Woodford Flood ALERT flood gauge. There are also numerous peak flood level historic marks available for this event
- April 1989: 609mm rainfall at Crohamhurst over 8 days. This flood was classified as a major flood at BoM's Woodford Flood ALERT flood gauge. There are also numerous peak flood level historic marks available for this event. In the rainfall data provided by MBRC this event has only been picked up in the Crohamhurst pluvio data. It is expected that additional pluvio data could also be sourced from the BoM Woodford rain gauge.

3.1.2 Mary River

If sufficient peak water level flood marks can be obtained, the following historic floods are considered the most appropriate for calibration and validation of the Mary River catchment.

- March 2003: 519mm rainfall at West Bellthorpe rain gauge over 41 hours (peak 6 hour intensity of 54mm/hr);
- February 1999: 489mm rainfall at West Bellthorpe rain gauge over 4 days (peak 6 hour intensity of 19mm/hr).

3.1.3 Neurum Creek

If sufficient peak water level flood marks can be obtained, the following historic floods are considered the most appropriate for calibration and validation of the Neurum Creek catchment.

- February 1999: 502mm rainfall at Mount Mee rain gauge over 93 hours (peak 6 hour intensity of 21mm/hr).
- March 2009: 350mm rainfall at Mount Mee rain gauge over 76 hours (peak 6 hour intensity of 15mm/hr).

3.1.4 Byron Creek

Calibration of the Byron Creek catchment is not considered feasible due to the lack of both suitable rainfall data and also the expected lack of flood marks that will be available in this bushland dominated catchment.

3.2 Feasibility of Calibration/Validation

3.2.1 Stanley River

Calibration and validation of the Stanley River catchment is considered feasible based on the data provided by MBRC. There are sufficient historic flood level marks and rainfall data to carry out these tasks for the events described in Section 3.1.1.

It is however recommended that additional pluvio data be sourced from the BoM Woodford rain gauge for the April 1989 event.

3.2.2 Mary River & Neurum Creek

There is sufficient rainfall data for both the Mary River and the Neurum Creek catchments for the events described in Section 3.1.2 and Section 3.1.3. Unfortunately no historic water level data is currently available in either of these catchments. Consequently, historic flood level data would need to be collected to undertake calibration and validation.

3.2.3 Byron Creek

Calibration of the Byron Creek catchment is not considered feasible due to the lack of both suitable rainfall data and also the expected lack of flood marks that will be available in this bushland dominated catchment.

4. RECOMMENDATIONS

4.1.1 Stanley River

It is recommended that calibration and validation of the Stanley River models be carried out for the events detailed in Section 3.1.1.

It is recommended that additional pluvio data be sourced from the BoM Woodford rain gauge for the April 1989 event.

It is also recommended that the complete historic record be sourced for the Woodford Stanley River flood gauge.

It is recommended that data associated with design and historic flood levels in Somerset Dam be sourced. The reason for this is that the water level in the dam will influence flood levels in the lower Stanley River Catchment.

4.1.2 Mary River & Neurum Creek

It is recommended that MBRC collect historic flood level data for these catchments for the events detailed in Section 3.1.2 and 3.1.3.

4.1.3 Byron Creek

It is considered that no historic calibration can be carried out for the Byron Creek catchment and that calibration parameters for the Byron Creek models be based on the calibrated values of the remaining package 5 minor basins.

5. REFERENCES

Bureau of Meteorology, September 2009 (last website update), “FLOOD WARNING SYSTEM for the UPPER BRISBANE RIVER ABOVE WIVENHOE DAM” (http://www.bom.gov.au/hydro/flood/qld /brochures/brisbane_upper/brisbane_upper_above_wivenhoe_dam.shtml)

GHD (for MBRC), June 2010, “Regional Floodplain Database, Sub-project 2K Historic Flood Information”

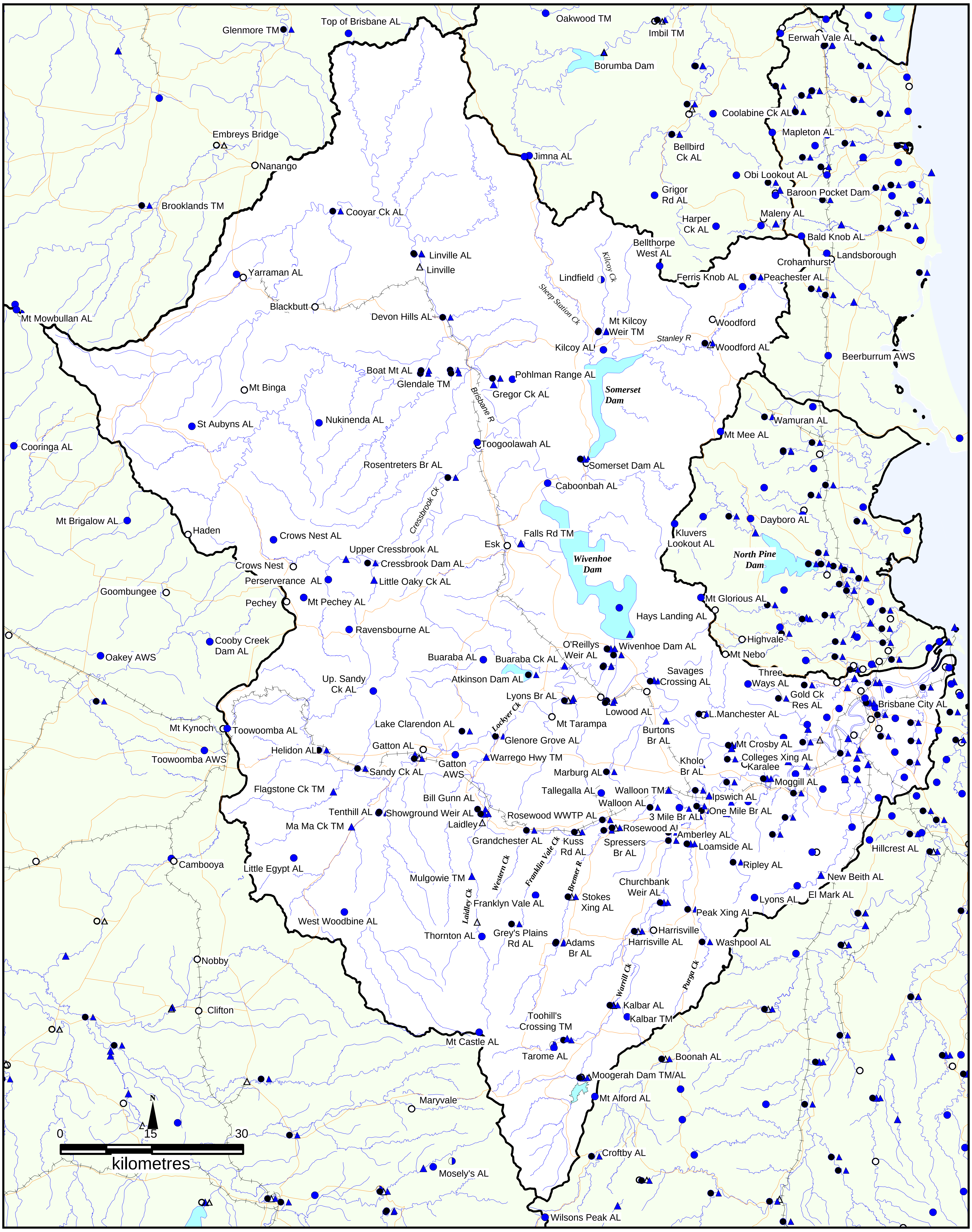
Sargent Consulting (for the Caboolture Shire Council), March 2005, “Stanley River Flood Study Final Report”

Appendix 1 - BoM Brisbane, Bremer, Stanley Rivers Flood Warning Network

Australian Government

Bureau of Meteorology

MAP 143.1



◑	Manual Heavy Rainfall Station
○	Daily Reporting Rainfall Station
△	Manual River Station
●	Telemetry Rainfall Station
▲	Telemetry River Station

BRISBANE, BREMER & STANLEY RIVERS

FLOOD WARNING NETWORK

Major Roads

Railway

Revised: Nov 2009

r:/pub/maps/map03/map143_1.wor